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MACHINE DESIGN

THE PROFESSIONAL JOURNAL OF CHIEF ENGINEERS AND DESIGNERS

Volume 12 — NOVEMBER 1940 — Number 11

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MACHINE DESIGN

Obtaining Accuracy, High Speed in Welding Unit

By Wm. Klingeman
Federal Machine & Welder Co.

IN LINE with modern design trends, the newly developed flash welding machine illustrated in this article embodies modernistic styling and contains all the necessary features essential to satisfactory operation. The foremost advantages of previous models were developed further and incorporated in this machine along with many entirely new features.

Providing an accurate movable platen for precision results was one of the chief aims in designing the machine. To weld abutting edges of two pieces of stock, either round, flat, or formed sections, the edges must be held in perfect alignment throughout the weld cycle. Otherwise, when the upset pressures are applied, flat sheets will tend to overlap or in the case of the round and formed sections, the pieces will neither mate properly

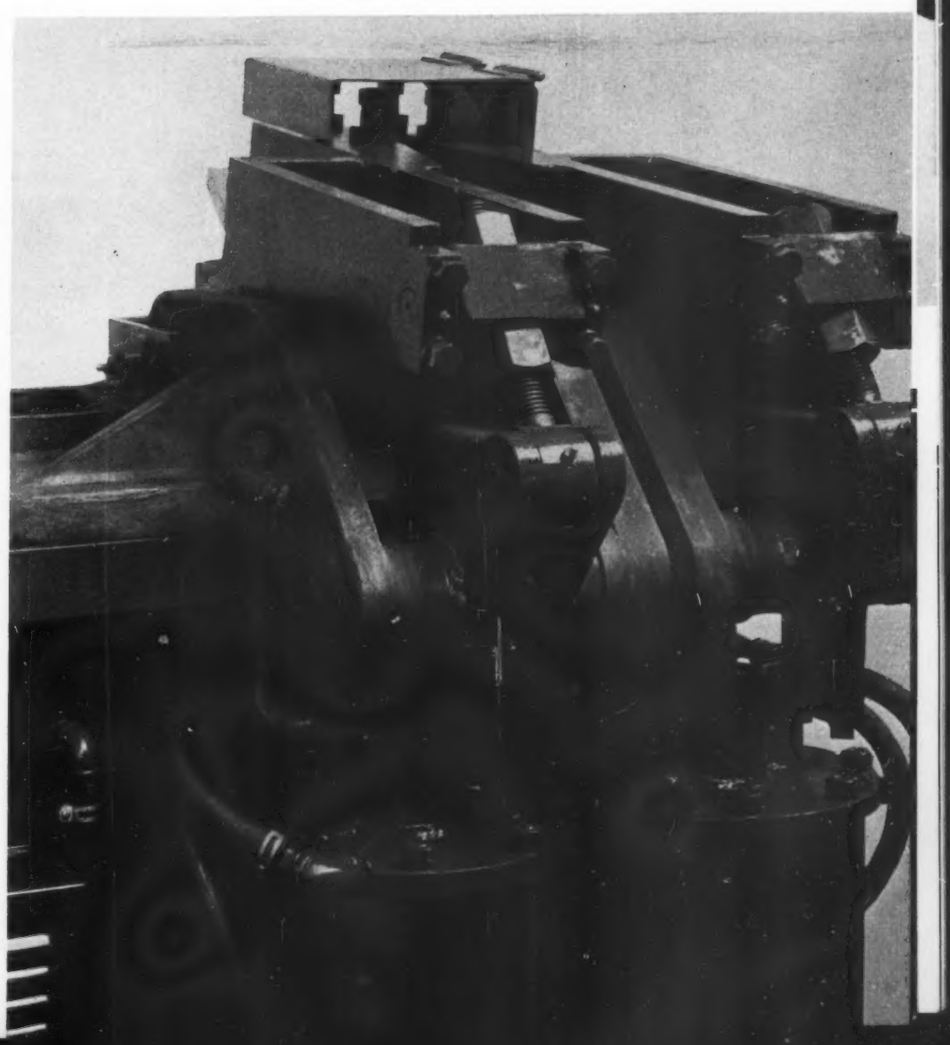


Fig. 1—Clamping mechanism toggles are pneumatically actuated for quick action and high pressures

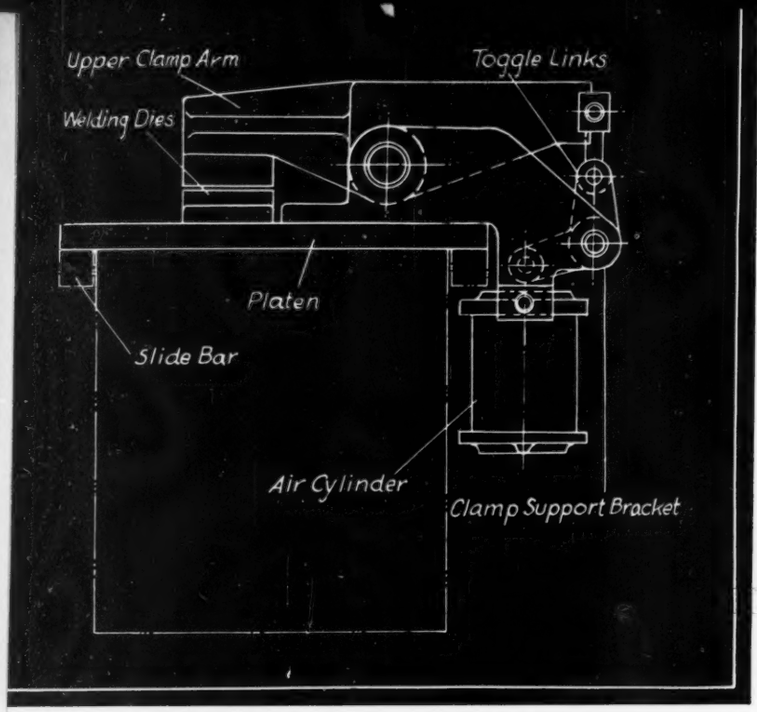


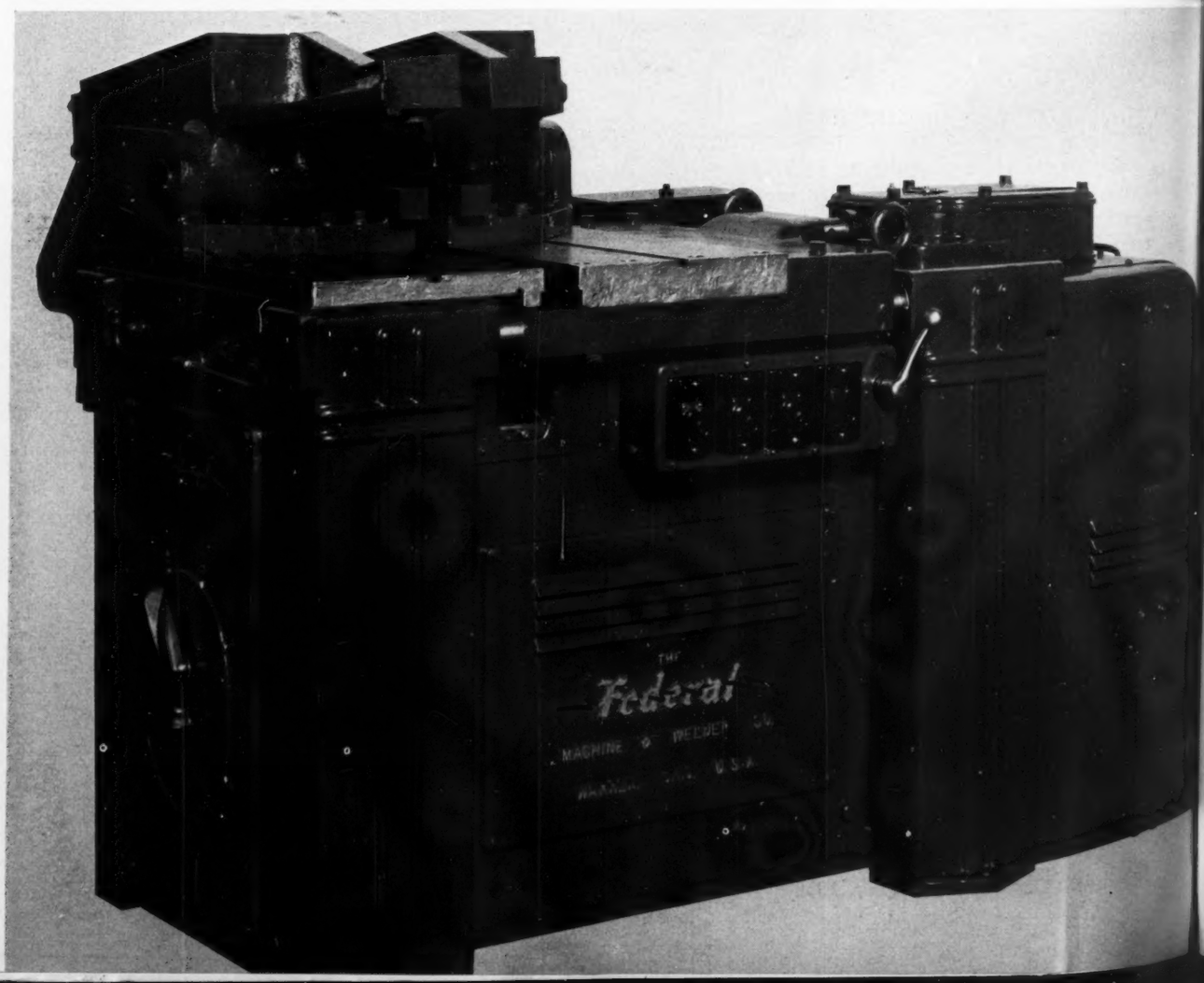
Fig. 2—Clamping arrangement linkage for holding workpiece securely during upset and weld

nor form a dependable, strong weld.

Platen is copper and is mounted on two side bars. These bars have precision ground ends that slide in bronze bushings. Close tolerance is held on each bearing and particuluar care is taken in the assembly of these component parts. The bearings are located at the extreme ends of the frame, see *Fig.* 3, giving the best possible condition for preventing lateral weaving movement of the platen. By mounting the bearings in this manner and sealing them, the possibility of flash and dirt cutting or scoring the moving parts is eliminated. Another problem involving the movable platen is friction and the time required to move the platen through its total length of travel. The importance of this, heretofore overlooked, sometimes necessitates the use of ball bearings.

Steel construction is utilized for the main frame to withstand without distortion the high loading of the clamping and upset mechanisms. Cast steel bearing support housings for the side bars and movable platen are bolted at each corner of the frame. Clamping arms and supports are also of heavy fabricated steel. The entire secondary circuit, as shown in *Fig.* 5, is virgin copper. This includes the secondary, stationary and movable platens, die supports, and conductor bars. To make a connection in the secondary circuit between the secondary and the movable platen, hard drawn copper sheets .01-inch thick are used in building up the flexible laminated leads. These allow the necessary

Fig. 3—Styled flash welder accommodates fixtures of various designs for many kinds of welded assemblies



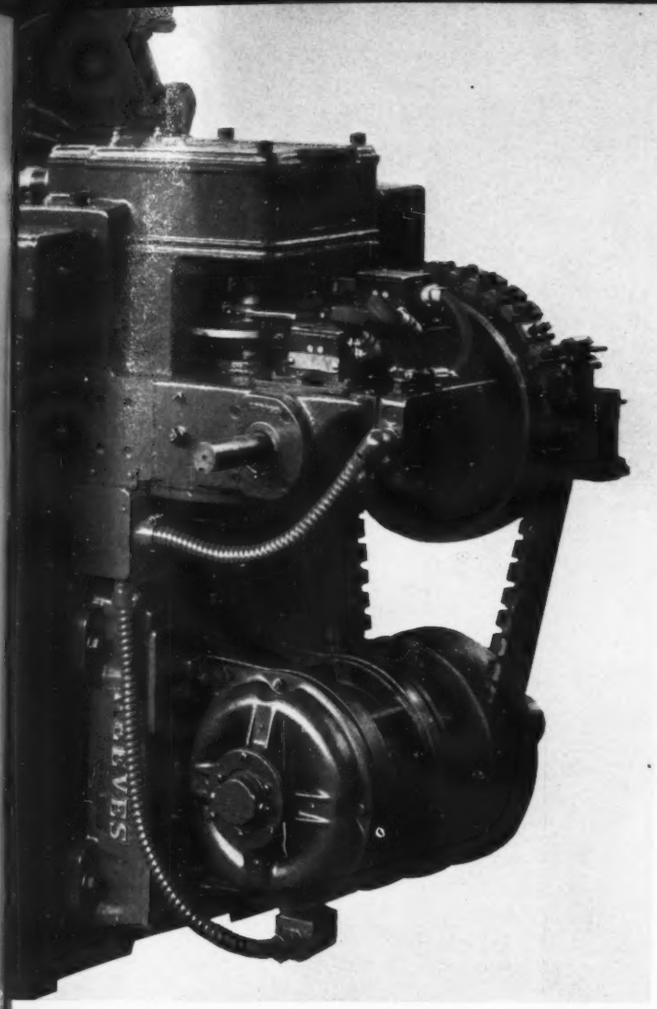
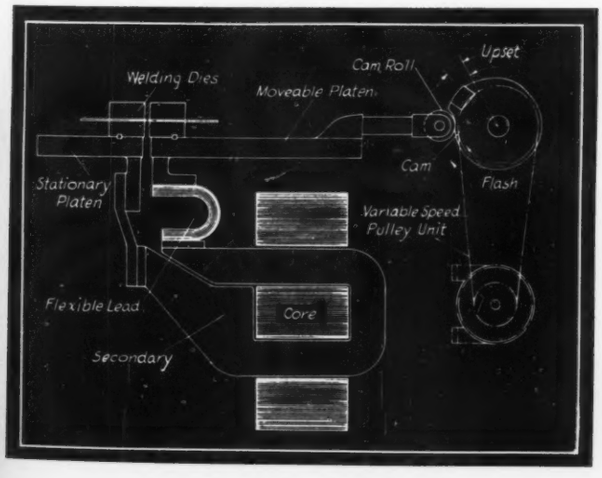


Fig. 4—Drive, with cover removed, utilizes variable speed unit for controlling cam action. Separate cams are generated for each particular welding job

Fig. 5—Secondary circuit and drive. Flash and upset cam is driven by variable speed unit



travel and give ample conductivity. A built-in flash chute, located under the center line of the weld, is designed to be easy to clean and to seal-in all flash, preventing it from reaching the transformer mounted in the frame below.

Transformer is "pancake flashproof" construction. Secondaries are cast copper and primary windings are hard drawn copper. Primary coils are tapped to facilitate the various increments of heat change required. To provide an easy means of changing heat, a plug type heavy-duty regulator is used. It is mounted adjacent to the transformer within easy reach of the operator. For the transformer core, silicon core iron is used.

Cooling Tubes Are Cast In

Attention has been given to the water cooling problems throughout the entire secondary circuit. This includes the cast secondaries, welding dies, platens and current conductor bars. The method of cooling is either to cast in seamless steel or copper tubing in place, formed to the desired shape, or to drill out various cooling holes.

In flash welders the upper dies usually are steel while the lower ones are copper base alloy, possessing outstanding physical properties such as high conductivity, wear resistance, corrosion resistance and high strength. Current is brought only to the two lower dies.

Welder is built as a flat top unit to accommodate clamping fixtures of various designs for the many welded assemblies required by industry today. Parallel keyways on the stationary and movable platens match the keyways on the clamping fixtures to insure alignment of these units at all times. Naturally, for a high production setup, a clamping fixture of rapid and positive action is required while for a low production operation, low-cost hand operated clamps sometimes suffice. However, the most widely used is the style shown in *Figs.* 1, 2 and 3. This clamp is a vertical arm type and is used on machines welding straight stock of any shape.

For mild steel, clamping pressures are at least four

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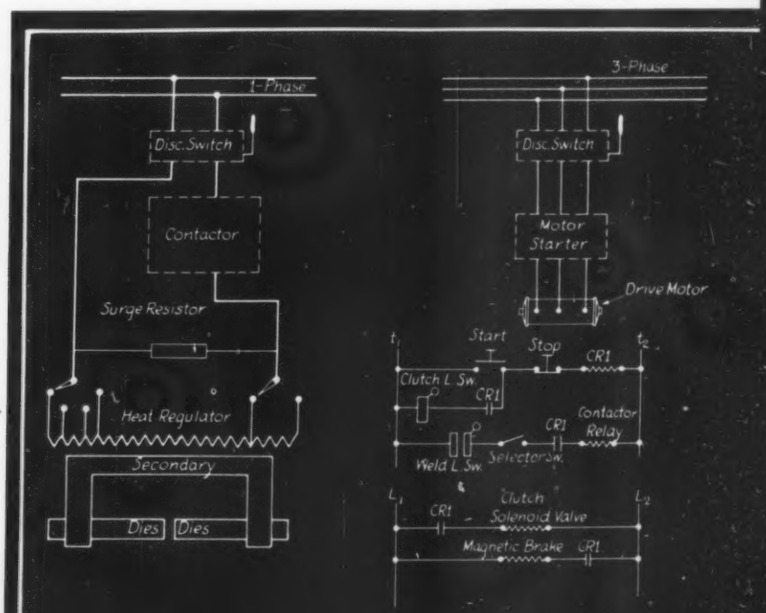
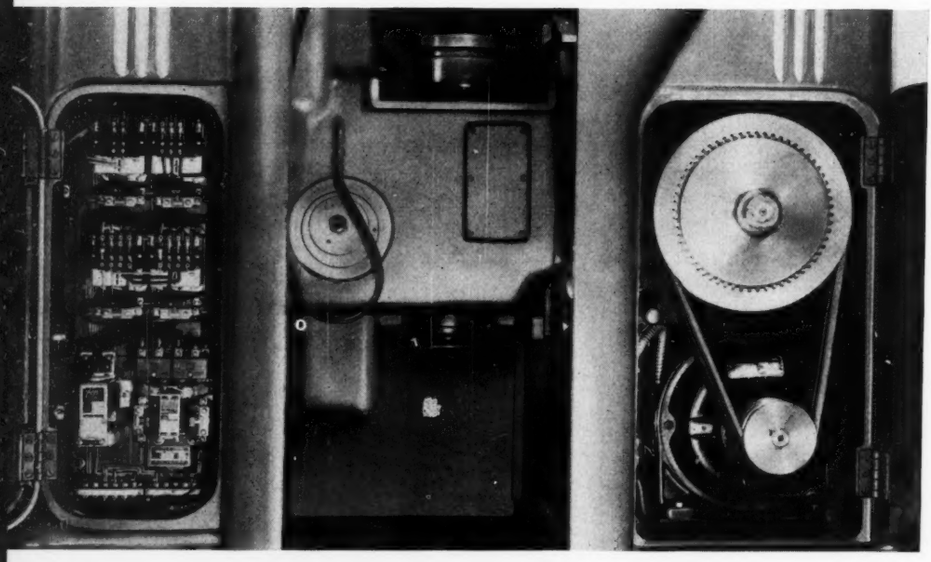


Fig. 6—Schematic wiring diagram shows connections and controls for transformer and drive motor

Scanning the field FOR IDEAS

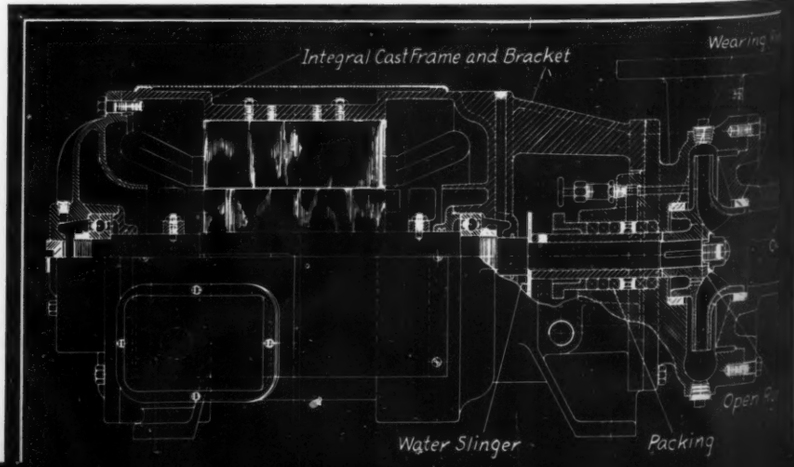


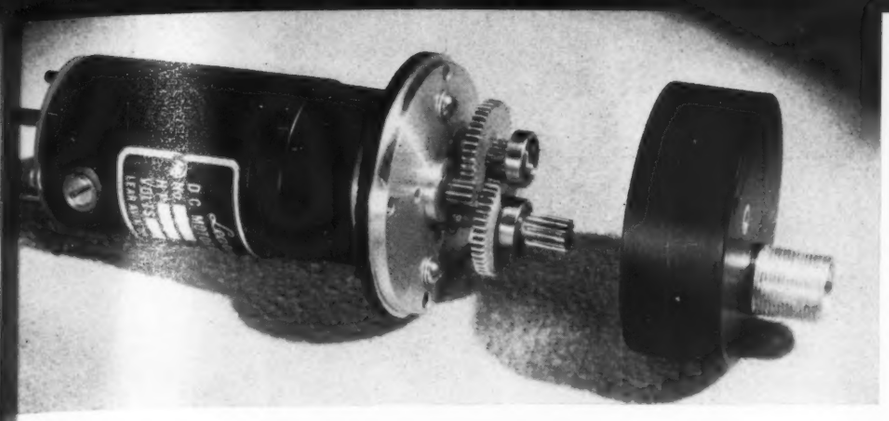
Hydraulically actuated, the disk clutch on the Barber-Colman hobbing machine contributes to smooth operation and facilitates automatic cycling. At the same time maintenance is reduced and natural wear is automatically compensated. A dry operating clutch, it has a single plate of large diameter and is contained in the V-belt sheave of the main drive. The sliding member is actuated through a sleeve connecting a piston and cylinder mounted on the drive shaft.

Oil under pressure is delivered from the hydraulic system to the cylinder by means of a stationary casing on the drive shaft and connected with the requisite ports. The cylinder is anchored against movement on the shaft. Engagement of the clutch is controlled by a valve connected to the cycle lever mounted on the central control panel.

Unit construction increases in its application as manufacturing facilities are improved. A typical example is a pump recently developed by Allis-Chalmers. Motor frame, pump bracket and feet are an integral casting, as shown in the drawing. Increased cost due to the more complicated casting is easily offset by reduced machining and assembly operations. In addition greater rigidity and better alignment are maintained in service providing longer life of unit.

This type of construction eliminates two fitted machined surfaces and associated drilling, tapping and assembling. Also, proper clearance between runner and rings is more readily provided and a longer stuffing box with more accessible packing gland is utilized for the same length of shaft.

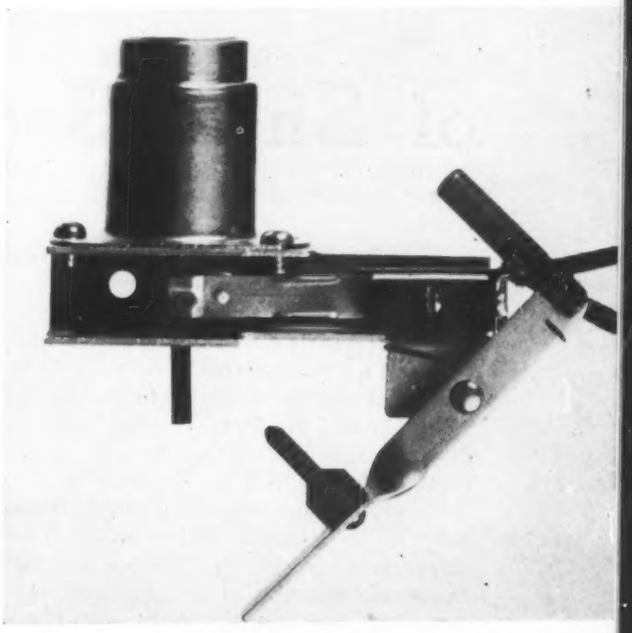




Sensitive operation is obtained in this unusual motor control unit by removing the inertia effect of the motor rotor through the use of a magnetic clutch. Between gear reduction and motor, the built-in clutch is compact and so designed that its major inertia parts such as coils are integral with the motor shaft. The driven member of the clutch is a disk designed to be in the path of multiple lines of force when the electromagnet is energized.

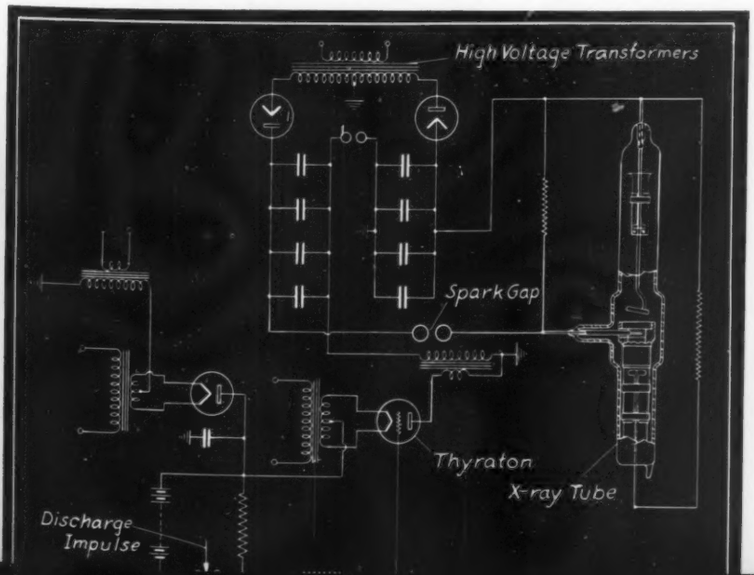
Energization attracts the disk to engage the clutch parts. Drive is by friction. When the circuit is broken, clutch is released and separated by a belleville spring. Acting coaxially the spring then holds the disk against a brake shoe on the inside of the motor end bracket, adding to the quickness with which the driven members stop. This unit, developed by Lear Avia Inc., is applicable to many remote control systems requiring close correspondence between initiation of signal and resultant movement.

Automatic switch employs an ingenious magnetic mechanism to control the operation of a G-E coffee maker. A small cylindrically-shaped alnico magnet, coupled by levers to a pair of contacts, is held in its upper position by a stainless steel keeper located on the lower end of the lower bowl tube. In this position the heating element is energized. As the last of the water leaves the flask, the magnet drops and turns off the unit. A thermostat controls a separate warming element to maintain constant temperature.



X-ray study of stresses in rapidly moving machine parts is possible with a new cold-cathode, ultra-high-speed X-ray tube developed by Westinghouse Lamp research laboratories. Radiographic exposures of one-millionth of a second are produced by the circuit shown in the diagram.

Breaking of a strand of wire by the moving part at the precise position required for study, initiates the discharge and exposes the film. The circuit works thus: Capacitors are charged to about 90,000 volts. A spark gap in series with the tube withholds voltage from the tube until an impulse is given from an auxiliary timing circuit. When the timing circuit is interrupted by the breaking of the wire, such an impulse is created and is added to the main voltage of the capacitors. Addition of the impulse causes the capacitors to discharge across the gap and through the tube. At that instant, momentary surge of X-rays is produced and the radiograph taken.



Key to the development of the tube is an auxiliary electrode which harnesses and puts to work a once-avoided phenomenon known as cold emission, which is caused by erratic flow of current from parts of the tube other than the cathode or filament.

New Designs Broaden Scope of Shaft Seals

By Kenneth D. Moslander

SHAFTS seals are precision parts. Any approach to their design and application should be made in full awareness of the technical factors requisite to satisfactory operation. Recent advances in seal development, while providing the engineer with new designs which will further broaden their field of use, make it emperative that he have ready access to those technical considerations necessary to determine the seal type best suited to his needs. Data essential in designing and applying these seals will be treated in three classifications: (1) Service factors affecting seal design, (2) Design and assembly of the component parts of the seal, (3) Application of the seal assembly to the shaft and housing.

Shaft seals consist of four essential parts: A flexible diaphragm, a seal nose bearing, a seal nose companion surface, and a spring element. The flexible diaphragm may be a metallic bellows as shown in *Fig.* 1, or it may be of rubber or one of the several available synthetics as illustrated in *Fig.* 2. Metallic bellows may be brass, phosphor bronze, cupro-nickel, ambrac, everdur, monel, low carbon steel, stainless steel, as well as silver-clad brass bellow or any of the above plated with chromium or cadmium.

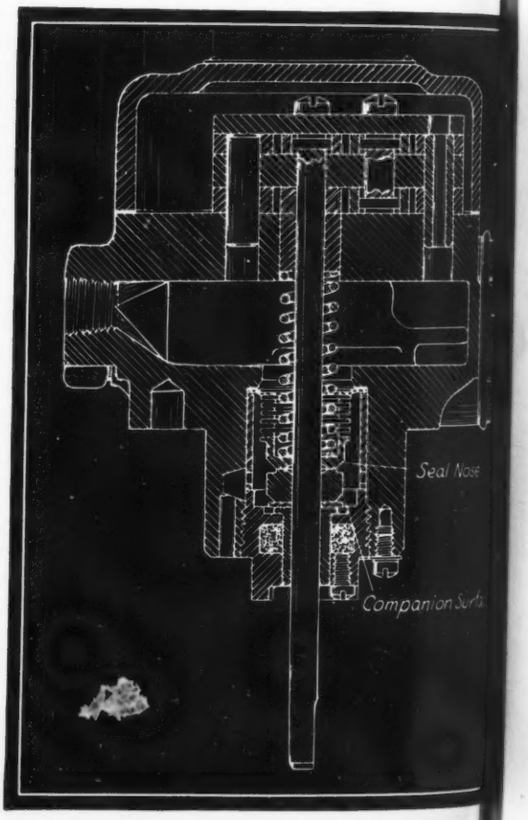


Fig. 1—Shaft seal companion surface is pressed on the shaft in this fuel oil pump

Three common types of seal nose bearings are in general use, these being leaded bronze, graphitic carbon, and phenol formaldehyde synthetic resin. The leaded bronzes are available in several grades for a wide range of speed and load requirements. The graph, *Fig.* 3, indicates the suitability of various grades of this material for pressures as high as 2000 pounds per square inch at a speed of 40 feet per minute to pressures of 25 pounds per square inch at a speed of 1800 feet per minute under conditions of good lubrication.

Graphitic carbon is used for seal noses impregnated with copper, babbitt, white metal or bronze, depending upon operating conditions of temperature and load. These nose pieces require no other lubrication than that provided by the graphite although the presence of such lubricants does not detract from the sealing efficacy. The phenolic resin used in nose pieces is combined with finely powdered bronze or other metal powders. The fluid being sealed ordinarily suffices to supply the necessary lubrication for

the proper operation of these bearing materials.

Material for the seal nose companion surface is, of course, dependent upon that of the seal nose. In combination with leaded bronze, carbon steel or stainless steel hardened to at least 600 Brinell should be used. Hardened Alleghany H-17 or S.A.E. 4615 as well as pack hardened S.A.E. X1315 have been used successfully for these parts. The bearing surface should be lapped smooth and parallel until optically flat. Two such pieces after being brought into contact on their bearing surfaces should adhere sufficiently to sustain their own weight against the pull of gravity.

Carbon May Run on Phosphor Bronze

Graphitic carbon nose pieces require neither such high hardness nor so refined a finish of the companion surface. Steel hardened to 400 Brinell or a close grained alloy cast iron is suitable. Phosphor bronze of 135 Brinell or over is eminently satisfactory. For sealing liquids at low pressures a fine turned surface will suffice for finish as the graphite of the nose piece will quickly fill in the serrations of the surface. For gases or high liquid pressures a finely finished surface is desirable to eliminate initial leakage during the running-in period.

Phenolic resin nose pieces operate satisfactorily against a close grained cast iron surface polished to a smoothness of 50 to 100 microns.

Too much stress cannot be placed on the necessity for accuracy of the springs used to load the seal bearing surfaces. These springs should be ground to produce full bearing on each end. The ground ends should be parallel to within 1 degree and the spring

TABLE I

Graphitic Carbon Dry Bearing Tests
Babbitt Impregnated Grade

Load lbs./sq. in.	Speed ft./min.	Friction Coefficient	Bearing Wear mm/1000 hrs.
103	4.6	.22	.15
196	4.6	.22	.13
15	200.0	.34	.12

should exert a uniform thrust parallel with the axis of the helix.

Temperature and the corrosive nature of the gas or liquid being sealed is the first factor to be considered in the selection of the type of seal to be used.

In applications where the nature and temperature of the sealed medium is such that rubber or synthetic rubber is impervious to corrosive attack or deterioration, seal diaphragms of these materials often provide an economical solution to the sealing problem.

Bellows Withstand High Temperatures

Highly oxidizing or corrosive liquids or vapors as well as temperatures of the sealed medium much in excess of the boiling point of water are factors which lead naturally to the selection of the metallic bellows.

Operating pressures of the sealed medium are a second factor affecting the choice of seal type. Due to the impracticability of perfectly pressure balancing the rubber diaphragm seal, i.e. eliminating the effect of pressure fluctuations on the sealing surfaces, the use of this type of seal for conditions subject to extreme pressure variations should be carefully analyzed. If the pressure unbalance is in the direction of increasing the load on the sealing surface with increasing pressure, care should be taken that the maximum pressure load plus the spring load does not exceed the recommended maximum for the seal nose material at the particular shaft speed. If the opposite direction of unbalance is used, i.e. if increased pressures decrease the load between the sealing surfaces, the spring must be sufficiently strong to resist the effect of the maximum pressure against the diaphragm and still maintain sufficient load on the sealing surfaces to prevent leakage. At the same time,

TABLE II

Physical Characteristics of Graphitic Carbon

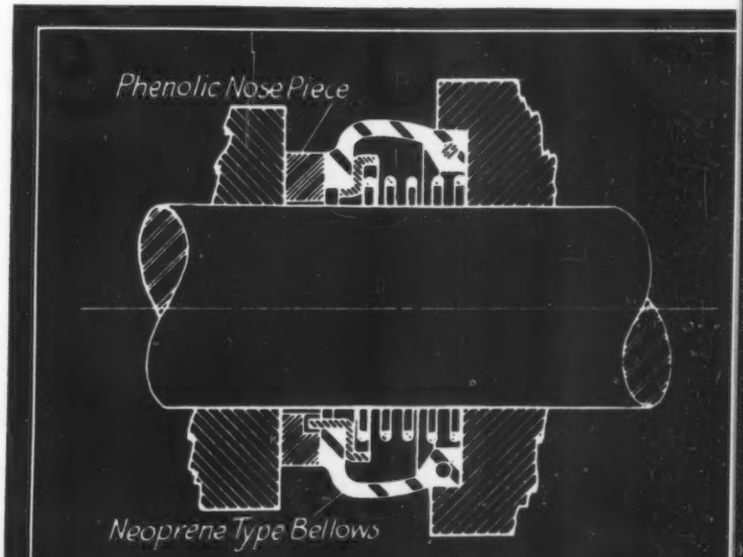
	Impregnating Metal		
	Copper	Babbitt	White Metal
Crushing Strength (lbs./sq. in.)	18000	20000	21000
Coefficient of Friction (260 ft/min; 10 lbs/sq. in.)	.11	.07-.08	.04-.05
Max. Operating Temp. (degrees Fahr.)	850	450	600
Tensile Strength (lbs./sq. in.)	2600	3000	3100
Shear Strength (lbs./sq. in.)	2500	3000	2900

the spring load must not be so great that, with zero pressure behind the diaphragm, the seal nose piece is overloaded.

Metallic bellows seals, on the other hand, may be designed for practically perfect pressure balance by making the area of the circle described by the seal nose equal to the effective area of the bellows. In this case, pressure fluctuations of the sealed medium have no effect on the load between the sealing surfaces, this quantity being determined only by the seal spring. Metallic bellows seals may also be designed for any predetermined amount or direction of unbalance. Thus these seals may be made to increase the load on the sealing surfaces with increasing pressures to insure against leakage or they may be so designed as to act as a relief valve in the event that the sealed pressure exceeds a certain maximum value.

Highly oxidizing or corrosive nature of the sealed

Fig. 2—Refrigerator shaft seal utilizes a bronze impregnated phenolic resin nose piece



medium also affects to some extent the selection of the seal nose and companion surface material. Whereas the carbon nose piece is most resistant to corrosive attack, any of the three materials (leaded bronze, graphitic carbon and phenol resin) are satisfactory in most services. In very severe service carbon has been used successfully in conjunction with a glass companion surface.

Extremely high temperatures require the use of carbon nose pieces. This material is satisfactory in an oxidizing atmosphere for temperatures up to 750 degrees Fahr. For nonoxidizing atmospheres temperatures up to the melting point of the impregnating metal may be used since the volatilization temperature of the carbon is in the neighborhood of 6300 to 6700 degrees Fahr.

Ring Simplifies Fastening

In service where the operating temperature is subject to wide variations, the low coefficient of expansion of the carbon, (.000001 to .000006 inches per inch per degree Fahr.) may introduce difficulties in rigidly attaching the nose piece to the header. Invar or Nilvar headers may overcome this trouble. Another successful solution is to use a free floating carbon annulus between two hardened steel or cast iron surfaces, one attached to the bellows and the other integral with the machine housing.

Leaded bronze is not recommended for service over 500 degrees Fahr. and the phenolic resin should not be used much over 300 degrees Fahr.

Lubricating problems impose another limitation on the selection of the seal nose material. Both leaded bronze and the phenolics require some lubrication. When the medium sealed is a liquid, this usually will afford ample lubrication; when a gas, some lubricant such as oil, glycerine, or one of the several available inorganic fluids or solutions may be supplied to the sealing surface. *Fig.* 4 shows a shaft seal assembly in which a lubricant pot is designed as a housing around the seal so that the glycerine, which is used in this application, acts not only as a lubricant but also serves as a coolant for the shaft seal bearing surfaces. Carbon nose pieces require no lubrication.

Fig. 3—Speed-load range of these leaded bronze bearing metals is typical of such materials available from several suppliers. Data was obtained under good lubrication

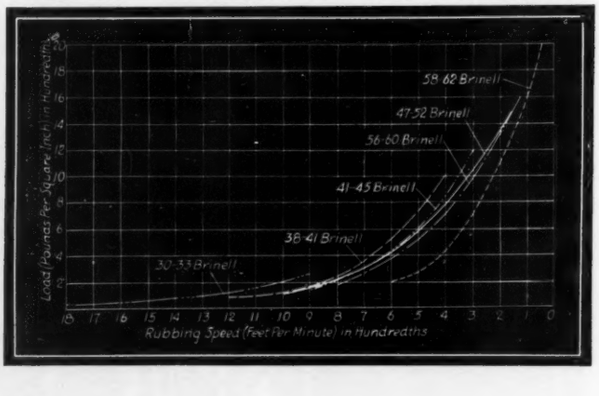


TABLE I shows the wear of a babbitt impregnated carbon bearing for various conditions of loads and speeds. TABLE II shows other physical properties of three types of this material. The intensity of load on the carbon seal nose surface is normally maintained at from 12 to 14 pounds per square inch although intensities as high as 140 pounds per square inch have been satisfactorily sustained. Properly designed and installed, the carbon nose pieces will usually outlast the equipment in which the seal is applied.

When the type of seal and the material and finish of the bearing parts has been determined there remains but the design details of the shaft seal itself.

In the case of the rubber or synthetic diaphragm type of seal, a leak-tight joint against the machine housing is usually obtained by spring or pressure loading as shown in *Fig.* 2. In some types of seal, however, in which the unit rotates with the shaft, the seal is obtained by a snug fit of the diaphragm around the shaft as shown in *Fig.* 5. In this case the stationary companion surface is either suitably gasketed or integral with the housing.

In the metallic bellows type seal an end flange for fastening to the housing is soldered to the bellows on one end. On the other, a header for holding the nose piece is applied. Soft solder is ordinarily used to make up these joints although silver solder may be used for high temperature service. In performing these soldering operations extreme care should be used to avoid overheating the bellows. For soft soldering, fluxes containing any ammonium compounds should be avoided to eliminate the possibility of intergranular corrosion of the bellows. The safest flux is a water or alcohol solution of U.S.P. zinc chloride. Whenever possible the soldering operations should be turned over to the bellows supplier who is fully equipped and experienced to do this job.

Ring Width Varies With Diameter

The critical design consideration of the leaded bronze seal nose is the width of the ring. This should vary from approximately .040 inches for ¾-inch diameter shafts to .125-inch for 2½-inch diameter shafts. The nose piece should be cut back from the bearing surface at an angle of about 45 degrees. The sealing surface should be carefully faced with a diamond tool. Lapping the surface with abrasive compounds should be avoided because of the danger of picking up particles of the abrasive in the seal nose which will, in service, act as a lap and destroy the finish of the companion surface. The nose pieces may be soldered, pressed or fastened with litharge and glycerine into the bellows header.

If a carbon nose piece is to be used, the width of the sealing ring should not be less than 7/32-inch. When an unfinished companion surface is used it is advantageous to cut back the nose piece sealing surface at an angle of about one degree to facilitate the running in of the bearing surfaces. The carbon nose may be fastened into the bellows header by spinning or by means of a press fit. Litharge and glycerine may be used as the sole fastening means or in con-

Fig. 4—Seal on this vertical shaft is lubricated and cooled with glycerine

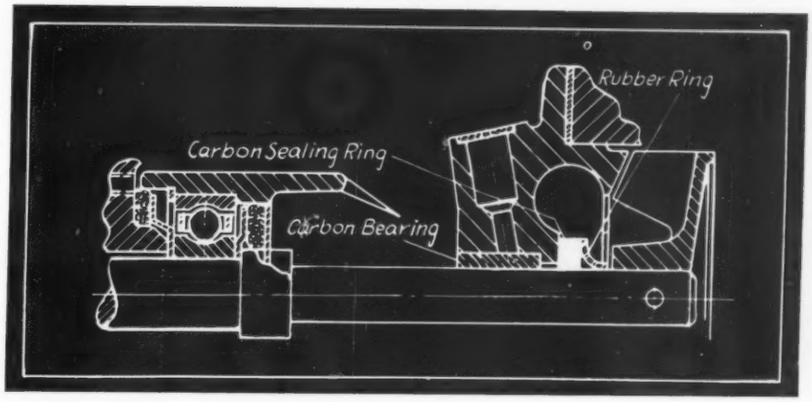
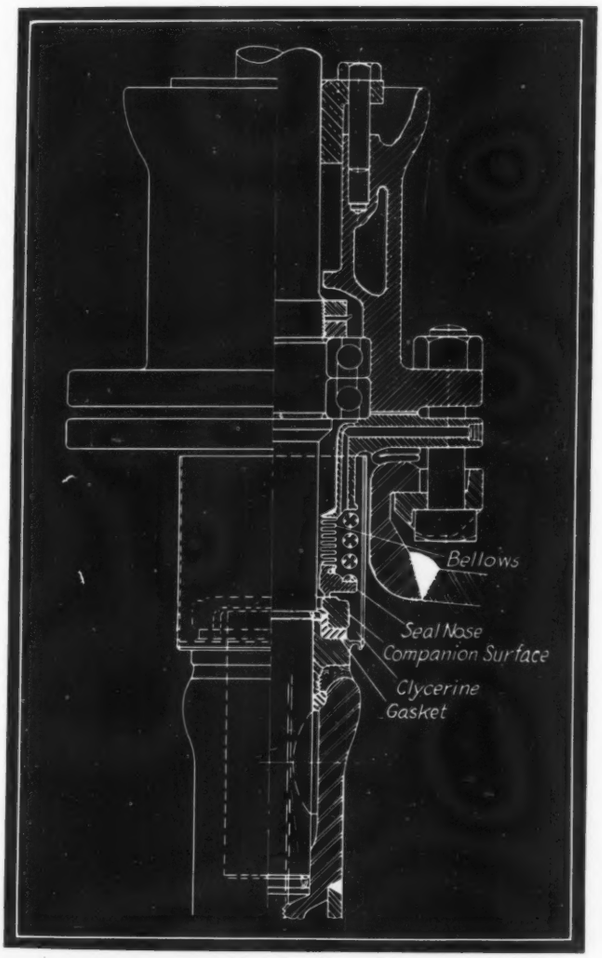


Fig. 5—Pressure of the pumped fluid against the diaphragm obviates the necessity of a spring in this assembly



junction with the two aforementioned to provide a gas tight seal. Some success also has been obtained in electroplating the carbon with copper and soft soldering the unit into the assembly.

In all cases where rubber diaphragm type seals are used, the joint between the nose and the diaphragm is sealed by the thrust of the spring supplemented by the sealed pressure against the diaphragm which is directly in contact with the back of the seal nose. The joint so obtained is exemplified by *Figs.* 2 and 5.

In installing the shaft seal the concentricity of the assembly with the shaft is of vital importance not only to insure uniform pressure on the sealing surface but also, in the case of the bellows type seal, to avoid transverse loads on the bellows.

Equally essential to the long life and satisfactory operation of the unit is the proper guiding of the seal nose header particularly when narrow leaded bronze nose pieces are used. The headers should preferably be guided in the housing bore although guiding around the shaft as in *Fig.* 1 is satisfactory. The clearance in the guide should be as small as possible; never more than .015-inch. The purpose of this guiding restraint is to prevent the seal nose from floating radially on the companion surface thus forming an uneven seat which will inevitably result in leakage.

One final consideration in the design and installation of shaft seals cannot be overemphasized; that is the necessity that the shaft run true and be as free as possible from axial float. This usually resolves itself into a bearing problem. *Fig.* 4 illustrates how this dynamic stability is achieved in one application by the use of preloaded ball bearings.

True Running Shaft Essential

Radial vibration or eccentric rotation due either to shaft flexure or faulty installation will speedily destroy the sealing efficiency not only for the reasons stated above for the necessity of a header guide but also because of the strong probability, particularly on high speed shafts, of the vibration setting up chattering between the sealing surfaces. Such chattering will inevitably result in immediate leakage and eventual destruction of the sealing surfaces.

Application of shaft seals is most widespread on equipment where the joint is either inaccessible or likely to be neglected by the ultimate user, such as refrigerating units, automotive oil and water pumps and fuel pumps. Self-evident from the nature of these applications is the fact that, assuming correct design and proper installation, the shaft seal may be relied upon for a practically indefinite, trouble-free life.

MACHINE DESIGN gratefully acknowledges the cooperation of the following companies in the preparation of this article: Clifford Manufacturing Co., Fulton Sylphon Co., Morganite Brush Co., Moraine Products Division of General Motors, Pfaudler Co., Carrier Corp., Sumet Co., Saginaw Bearing Co., Brunner Manufacturing Co., Kellog Division of the American Brake Shoe and Foundry Co.

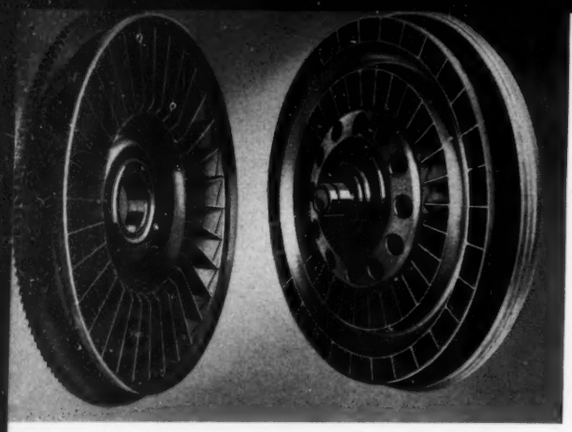


Fig. 1—Impeller (left) and runner of Chrysler fluid coupling. Addition of torus ring on runner is designed to overcome critical vibration period

Beneath That Strea

By A. H. Allen

ENGINEERING specifications for 1941 automobiles show that although radical changes are absent, designers have effected significant advances in a host of details, many of which have possible adaptation to other machines and other industries.

Particular attention appears to have been concentrated on transmissions, following the successful introduction of the Oldsmobile Hydra-Matic transmission (M.D., Nov., 1939) and the Chrysler fluid drive on 1940 models (M.D., Jan., 1939). For 1941, Chrysler has extended the fluid drive to De Soto and Dodge, and has developed a new semiautomatic transmission for De Soto and Chrysler. The new transmissions still are supplied only as optional equipment.

Governor Controls Gear Change

The De Soto transmission, termed Simplimatic, provides two sets of gear ranges, high and low, selected by manual control and using the conventional clutch pedal for the shift. The shift within each range, from third to high, or from first to second is accomplished by removing the foot from the accelerator pedal thereby actuating a single vacuum-controlled diaphragm which operates an auxiliary shifter fork at the forward end of the transmission case.

Timing of the automatic gear changes is controlled by a centrifugal governor driven off the transmission countershaft. The governor operates an electric solenoid which releases a latch in the diaphragm and permits it to effect the gear change. The governor is set to permit a shift from third to high at about 15 miles per hour and an automatic return to third when speed drops below 13. Similarly, the shift in low range is made at about 8 and the return at 6 miles per hour.

Under normal driving conditions the car is started in third gear and the automatic shift made into fourth or direct drive, minimizing the amount of manual shifting necessary. The gearbox is arranged to freewheel in first and third ratios, being locked in second and fourth.

A manual lockout is provided to pivot the vacuum diaphragm out of position and thus lock the transmission in second or high gear to permit starting a stalled engine by towing or pushing the car. This is necessary because of the previously indicated freewheeling condition in first and third gear ratios.

A further innovation is a so-called kickdown switch installed on the carburetor which will automatically return the transmission from high to third or from second to first when the accelerator pedal is depressed all the way. However, this is not possible when car speed is above 53 miles per hour because a limit switch in the carburetor venturi prevents "kickdown" at this high speed.

All gears in the transmission, except the reverse combination, are of the conventional helical type and are in constant mesh. To provide for the free-wheeling or over-running clutch previously mentioned, the gearcase is made somewhat larger than in the past. Sliding clutches or collars are used to engage the various gearsets with the shaft. These clutches are actuated by the manual shift lever and the vacuum diaphragm control.

Noteworthy is the change that has been made in the Chrysler fluid drive or hydraulic coupling unit. At the center of the vanes of the runner has been added an annular or half-torus ring, shown in *Fig.* 1, designed to overcome a critical vibration period noticed on previous designs. Continued on Chrysler fluid drive installations is the use of a dashpot throttle

Fig. 2—Bell crank on Oldsmobile starter pedal linkage automatically moves transmission control lever into neutral position when starter is actuated

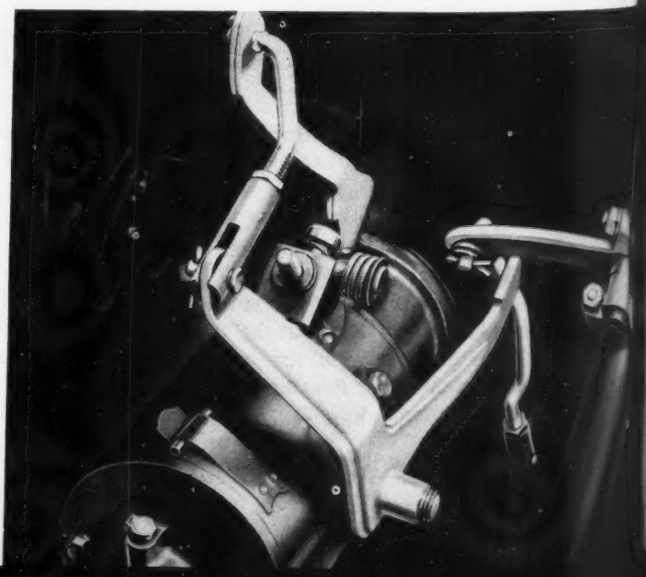


Fig. 4—Compound dual carburetors require new intake and exhaust manifolding on Buick engines for 1941

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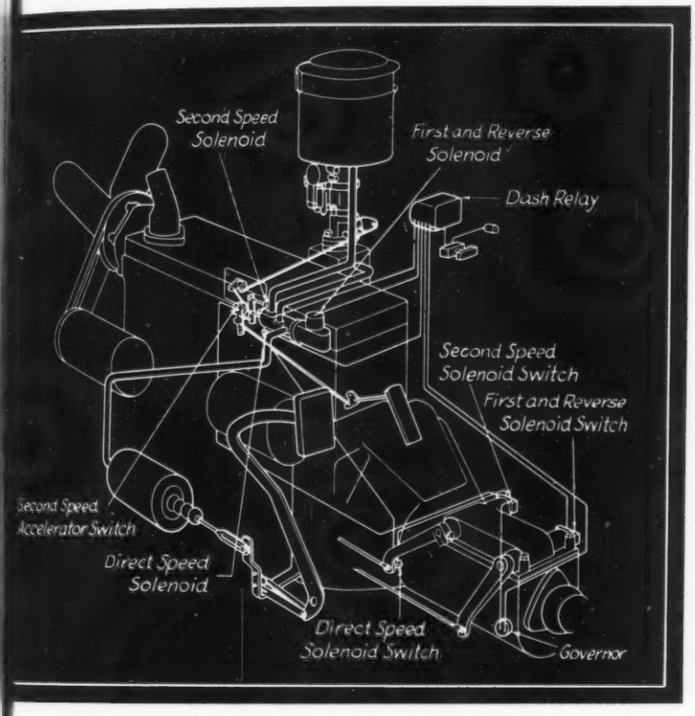

Fig. 3—Automatic clutch, controlled by vacuum and solenoids, is available on Packard models

control on the carburetor to provide slow throttle closing essential to avoid engine stalling.

Fully automatic transmission for Olds models is continued substantially unchanged this year, although the correction of numerous production difficulties encountered in manufacturing this unit, it is hoped, will permit quadrupling the output during the coming year. One change made this year is the provision of a bell crank on the starter linkage, *Fig.* 2, which is connected to the gear shifting linkage in such a way that when the starter is depressed the shift control is moved into neutral position.

Vacuum booster unit, of the type used hitherto by Chevrolet for assisting in the manipulation of manual steering column gearshift levers, has been made available on Dodge and Plymouth models, further accentuating the trend toward easier gearshifting.

A third innovation in transmission control is the Packard electromatic clutch, shown diagrammatically in *Fig.* 3. Affording an excellent example of the adaptability of solenoids to sequence control, this device provides for automatic clutch operation except when it is not desired and a lockout switch is thrown on the dash, actuating a solenoid operated control valve.

Engagement or disengagement of the clutch is accomplished in accordance with driving requirements by a vacuum cylinder which is connected to the clutch release mechanism in such a way that movement of the clutch pedal itself is avoided during automatic clutching and declutching. Engagement or disengagement of the clutch is controlled primarily by the accelerator pedal through solenoids and solenoid switches for the three gear ratios, plus a relay mechanism on the dash. The clutch disengages when the accelerator pedal is released and engages when the pedal is depressed. Sequence of operations with automatic control is described below.

Sequence of Operations in Automatic Control

With the accelerator pedal released, the gear shift lever is moved into the first speed position, which causes the first and reverse switch to energize its solenoid. Movement of this solenoid compresses a diaphragm spring in the clutch control operating valve to a predetermined, fixed value. With this adjustment, as the accelerator pedal is depressed, the vacuum in the master cylinder is reduced from its maximum to an amount just sufficient to balance the clutch spring load at the initial engaging point.

The car is accelerated, the accelerator pedal released, and the shift made into second gear. This breaks the circuit on the first and reverse switch, which de-energizes the solenoid, restoring the diaphragm spring to its original adjustment. This adjustment provides a more rapid rate of clutch engagement for second and high gear, in accordance with car speeds.

When the accelerator pedal is released and the shift made into high gear, a governor switch prevents clutch release above 12 miles per hour except when overruled by the direct speed switch. This permits the motor to be employed as a brake when decelerating, and eliminates free wheeling in high gear until a low car speed has been reached. When the accelerator pedal is released, the governor switch keeps the solenoid de-energized at car speeds in excess of 12 miles per hour. This cuts off the master cylinder from manifold vacuum, and prevents the clutch from automatically releasing until car speed drops below

12 miles per hour with the transmission in high.

If a shift from high to second gear is desired at a car speed in excess of this speed, clutch release is provided by the switch, which is actuated by the first portion of the gear shift lever movement, and over-rules the governor.

To promote longer clutch life and to improve declutching by greater plate separation when the clutch pedal is depressed, Buick has lengthened the pedal shank to obtain longer throw. Also, a new release yoke is used which is hardened all over, with special hardening at the ball stud socket to prevent wear and binding. The release equalizer is now assembled with a spring against the outer ball stud which maintains tension on the equalizer to prevent rattling. Spring steel pads are used on the release bearing retainer to prevent yoke pins cutting into the edge of the retainer. Bronze bushings are used in pedals to prevent scoring and corrosion.

The 8-inch friction clutch on Willys or Americar models (as they are now called) has a new type of vibration or shock dampener. Essentially it is an hermetically sealed cell at the center of the plate, containing a group of helical springs fitted with hydraulic plungers, the latter controlled by sealed-in grease. The mechanism, of the Atwood-Thelander type, resembles a shock absorber with hysteresis curve in the form of a triangle, giving low reaction at low end and extreme reaction at upper end.

Most unusual development in engines for the year is the system of compound carburetion devised for Buick power plants. This advance is significant of the modern engineering objective of designing machines to meet, more and more accurately, precise operating requirements. Two double-barrel carburetors are used, each slightly smaller than the single one used heretofore.

Carburetor Operation Synchronized

Mounting and manifolding of these carburetors on the left side of the engine are shown in *Fig.* 4. Functions of the carburetors vary with throttle opening and engine speed. Thus, on closed throttle or idling, air passing the front and rear throttles draws gasoline from the idler systems of both carburetors. With the throttle partly open, gasoline is fed from the idler system of both carburetors and the main system of the front carburetor. For so-called full-throttle operation, usually in high gear, operation varies with speed as follows: Below 15 miles per hour—front carburetor main system is functioning, rear carburetor is not; 15-20—front carburetor main system is functioning and rear carburetor is just starting to feed mixture; 35-40—both main systems are functioning.

Automatic choke and starter switch are on the front carburetor, as are the accelerating pump for momentarily enriching the mixture under conditions of sudden acceleration, and a main by-pass system which functions when throttles are nearly wide open. There are two throttles, each connected to the accelerator by rod linkage. Between the rear carburetor and the manifolds is the auxiliary throttle which is closed by a weight load and opened automatically by air pressure differential. This valve, however, is never

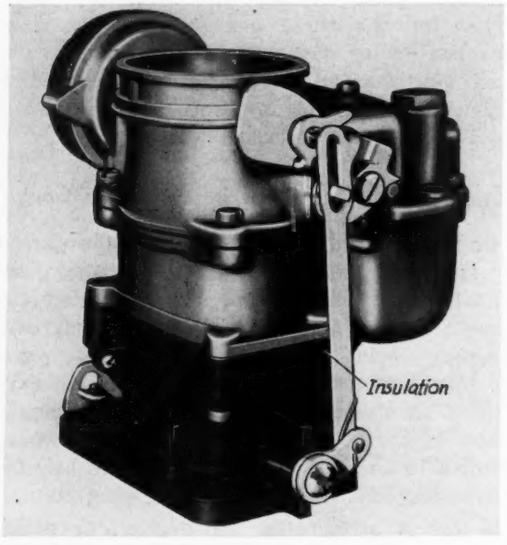

Fig. 5—Insulating washer of 3/8-inch bakelite is placed between throttle body and bowl casting of Oldsmobile carburetors

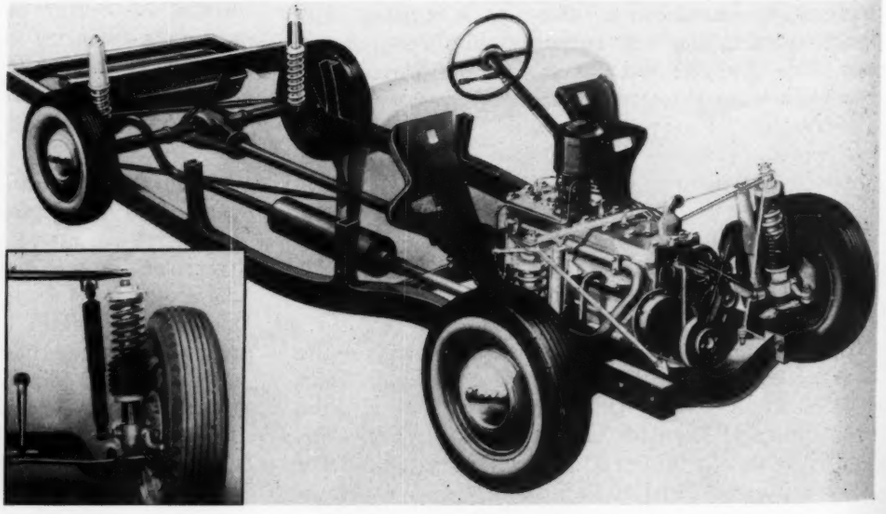

Fig. 6—Unitized all-welded frame and body construction is a feature of the new Nash 600 models. Inset shows closeup of front springing and shock absorber

tightly closed, for the idling system must operate at all times.

Actually the rear carburetor throttle is not connected directly to the accelerator but is actuated by a pick-up lever with a delayed initial opening. Hence the rear throttle does not start to open until the front throttle is opened more than half way.

Advantage of the system is claimed to lie in the fact that extra fuel is supplied only when needed. This, plus the fact that both carburetors are smaller, results in a reported 15 per cent better economy, plus the added value of the booster action of a second carburetor when the accelerator is depressed beyond the half-way mark.

With the new carburetion system, redesigned carburetor air intake is used which draws cool fresh air from behind the radiator grilles through a tube of fabric over spring wire, the latter acting also as a silencer.

Air Filters Aid Lubrication

Recognition of the deleterious effects of dirt in engines, even in climates where dust in the atmosphere is not normally excessive, has been fairly general throughout the industry. Corrective is the use of the so-called oil bath air cleaner as standard equipment. In addition to providing double insurance that the air will be thoroughly cleaned, the oil bath supplies a measure of lubricant vapor to the air and gives a slight degree of top lubrication to the engine in the fuel mixture.

Two recently perfected types of main crankshaft bearings are appearing in 1941 engines. One is the tri-metal bearing developed by the Moraine Products division of General Motors and used in Buick engines. It comprises a steel backing over which a layer of copper and nickel powders has been compressed and sintered, with a thin layer of babbitt applied under vacuum onto the copper-nickel matrix. Thin layer of babbitt, plus the cushioning effect of the matrix, are claimed to prolong life.

The other design is the micro bearing used in engines of the Chrysler line, which has a thin layer of babbitt directly on the steel backing shell. Thickness of babbitt varies between .002 and .0045-inch. Here again the exceptionally thin layer of babbitt is claimed to provide greatly improved resistance to impact and longer life.

Floating Strainer Reduces Grit

Novel design of oil strainer and intake pipe has been worked out for Plymouth engines. The strainer is pivoted on the intake pipe, permitting it to rise to a maximum angle of 18 degrees, thus riding or floating on the surface of the oil in the crankcase and circulating only the cleanest portion of the lubricant, since dirt and impurities settle to the bottom of the sump.

Reversing switch for alternating the flow of current through breaker points has been located on top of the starter in new Chevrolet engines. It is actuated each time the starting motor turns over the engine. Since there is a transfer of metal from one breaker point to the other, depending upon the direction of the current flow, a periodic reversal of the current flow minimizes the wear on contact points and thereby prolongs their life.

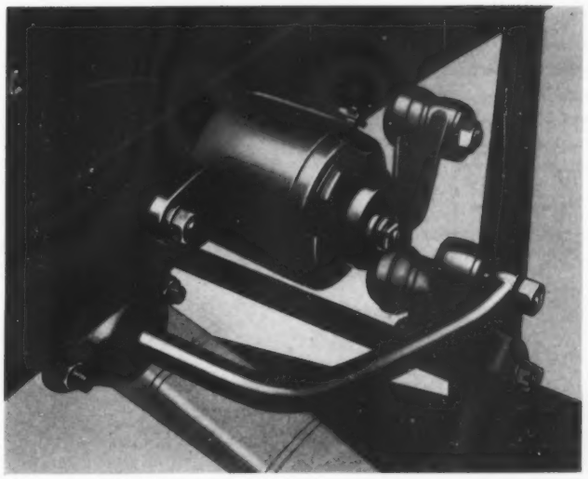

Fig. 7—New mounting for end of torsion bar and 20 per cent added fluid capacity in front shock absorbers give improved ride on Ford and Mercury

Carburetion has been improved on Olds engines from the standpoint of improved handling of hot fuels and elimination of hot starting difficulties, by the addition of a ⅜-inch bakelite insulator between the throttle body and bowl castings, as shown in *Fig.* 5. Olds engineers likewise have minimized the danger of spark plugs being shorted by water accumulation in the spark plug wells by redesigning cylinder heads with a groove extending lengthwise on the top of the head through the spark plug wells.

Sixes and Eights on Same Chassis

Both Olds and Pontiac this year are offering either 6 or 8-cylinder engines on the same chassis, with only a slight extra charge for the 8-cylinder installation. An ingenious mounting arrangement was devised to permit using the same sheet metal and the same frame, regardless of which engine is used. Rear mounting is exactly at the same point for either engine. At the front the mounting, on the Olds, is located on the forward side of the frame front cross member for the 8-cylinder engine, and at the rear of this cross member for the six.

Wiring congestion behind the instrument panel on Olds models has been relieved by redesigning the wiring and using grouped push-on connectors, simplifying assembly and giving greater accessibility for service.

Most unusual innovation in body construction is involved in the Nash Ambassador 600 model, a new low-price 6-cylinder car. As shown in *Fig.* 6, the frame is an integral part of the body construction, pillars and front bracing being welded to the frame

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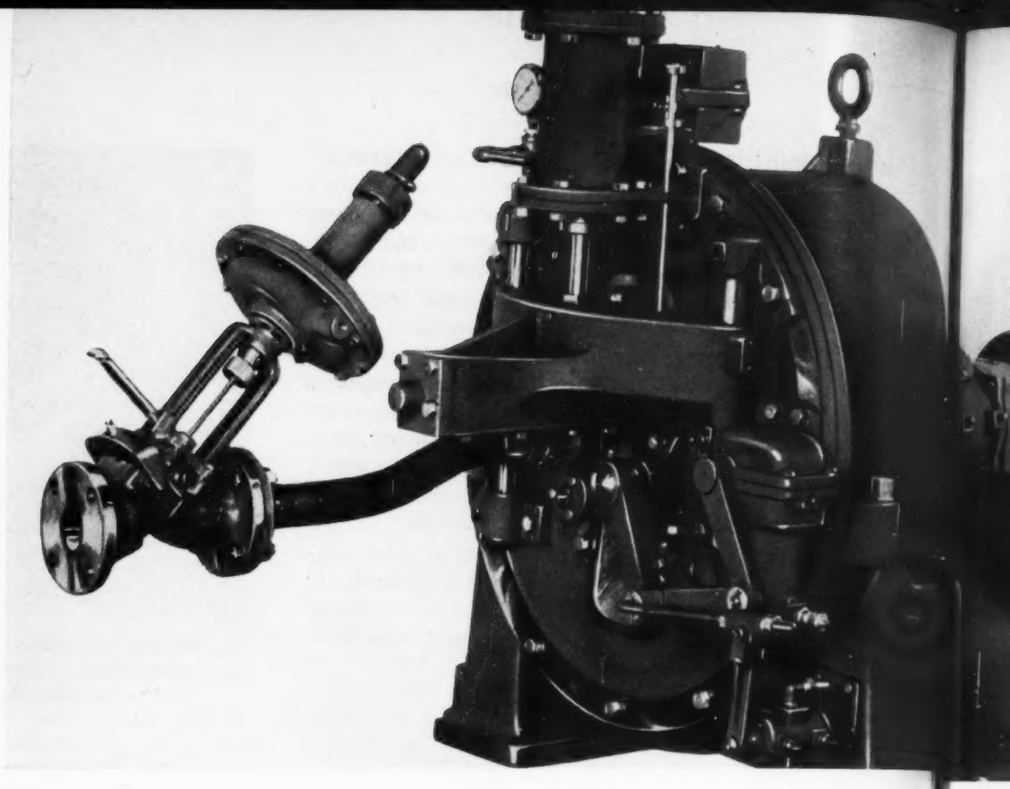


Fig. 1—Automatic cycle control and horizontal basket greatly extend capacity of machine. Although individual loads are small, cycle is shortened to increase production over that of larger sizes of centrifugals

Redesign for Automatic Cycling Increase Pro

By

A. U. Ayres

The Sharples Corp.

BASIC redesign, permitting the adoption of automatic cycling, has resulted in new methods of handling materials. Speeding up the cycle of operation, eliminating hand labor and obviating constant attention of an operator are achieved in the extractor machine for crystal drying illustrated in *Fig.* 1. Formerly, a vertically mounted basket of large diameter with perforations through the basket wall, lined with screen or canvas was used in centrifugals for this type of work. Loading as well as unloading of the dried and washed

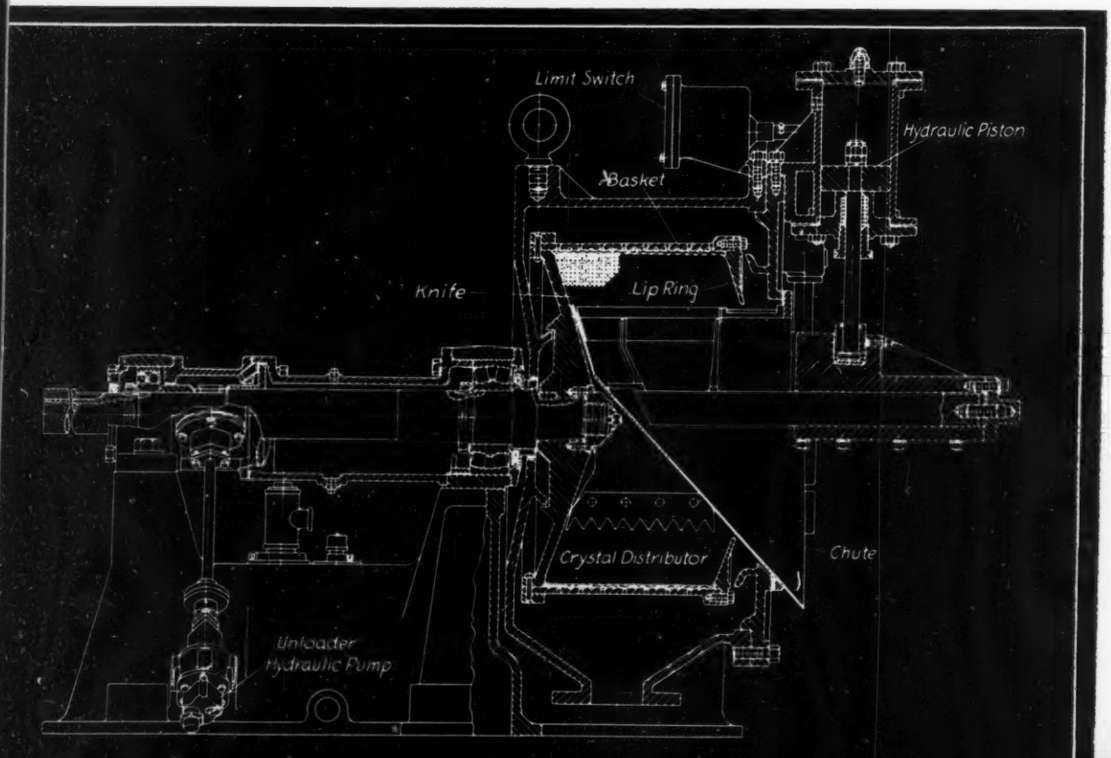


Fig. 2—Design of extractor shows advantages of horizontal basket in unloading. Distributor, unloader and discharge chute facilitate operation

Fig. 3 — Right — Pneumatically operated feed valve opens quickly and has a large area for fast loading of slurry

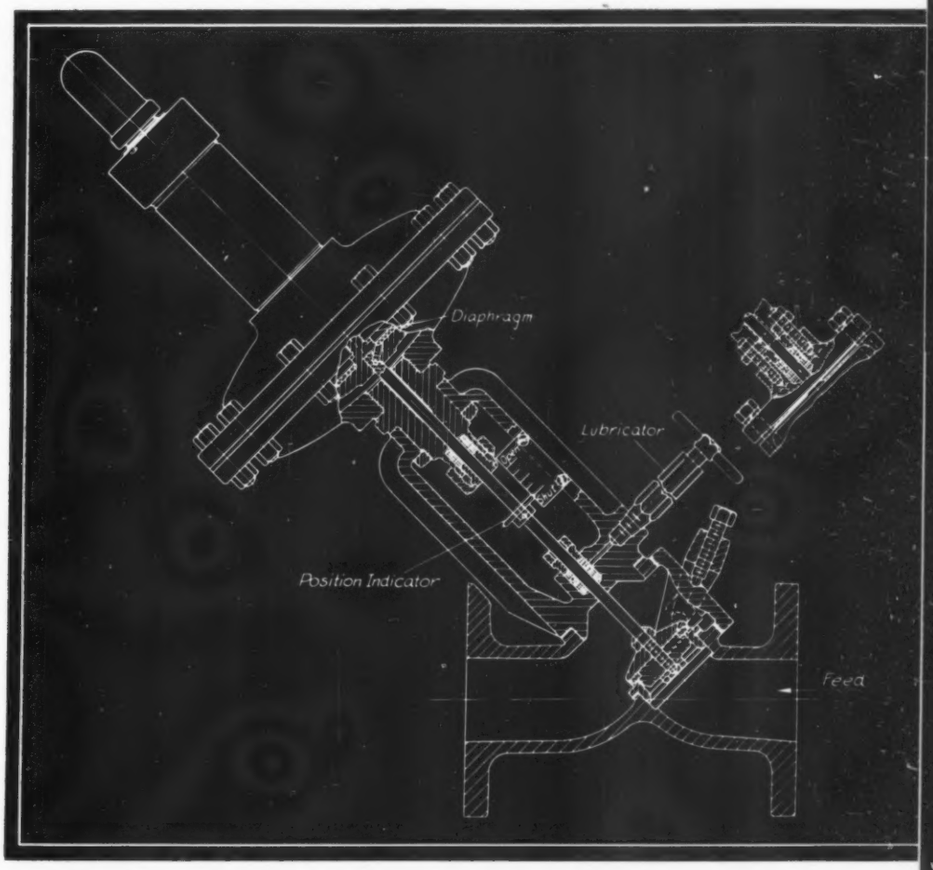
ease Production

crystals was done laboriously by hand.

Shown in the drawing, *Fig.* 2, are the features of this machine. In order to make possible the unloading of the basket cleanly and easily it is mounted horizontally. A chute is installed in such position that dislodged crystals are carried outside the machine to discharge into a pit or on a conveyor. To unload the crystals rapidly a knife extends the full width of the basket. The knife is mounted on a bar attached to a slidably mounted yoke the motion of which is controlled by an hydraulically operated piston. When oil pressure is applied the knife moves upward into the cake, completely unloading the crystals in a few seconds. This work is done while the machine is at full speed, eliminating time lost through deceleration and acceleration.

In previous machines of both the vertical and horizontal type the baskets are of larger diameter so that a considerable quantity of slurry can be introduced at one time, the designers feeling that this would result in the highest daily production of crystals. In such machines, however, the draining time is long, first because of a deep mass of crystals through which the liquid must work its way to the periphery, and second because large diameter bowls must be operated at relatively low centrifugal force, since the bursting stress of a rotating body is proportional to the square of the peripheral speed whereas centrifugal force varies as the diameter and as the square of rotational speed. By reducing the diameter, as has been done in the case of the machine now being described, much higher centrifugal forces are possible without encroaching on a satisfactory factor of safety, and when combining such forces with a thin layer, drainage is quick and complete. It is obvious, therefore, that high production rates are possible if all of the other steps of the cycle can be handled with a minimum loss of time.

Feeding is rapid, the slurry being introduced through a slotted pipe of large diameter that extends across the width of the basket, controlled by a specially constructed diaphragm valve. Rinse liquor is introduced in the same manner through a perforated pipe on the opposite side of the basket, and the steps of feeding, rinsing, spinning to dryness, and unloading are all set to a minimum time necessary for the particular application by adjustable electrical timers that operate air pressure control valves.



Valve Permits Fast Loading

A special feed valve, *Fig.* 3, permits a quick opening of large area so as to allow for prompt introduction of the slurry load. Pneumatically operated, the valve stem and parts are ordinarily stainless steel or monel metal, with a replaceable ring at the valve seat. A hand hole is provided so that the valve parts can be quickly replaced or repaired.

When delivering slurry into a rotating basket it is

rare that the slurry is evenly distributed, and any unevenness results in out-of-balance with consequent vibration. The vertical baskets are flexibly mounted so that a considerable unbalance can be tolerated without distress, the basket merely oscillating on its flexible members. Such oscillation cannot, however, be permitted when an unloader knife is to be drawn up close to the basket screen at full speed, as is the case with this machine. Fairly even distribution might be accomplished by a slow rate of feed, but this defeats the object of a short cycle for high production. The problem was solved by the introduction of a crystal distributor. In essence, it is a rake that rides on the surface of the solids in the basket and tends to spread them evenly. In this way extremely rapid loading is accomplished smoothly and automatically.

The entire cycle of operation is automatic, utilizing a control circuit which involves hydraulics, three pneumatic timers and a limit switch. Interconnections of these control elements are schematically shown in *Fig.* 4. Sequence of this cycle control is as follows:

Rotation of the basket tends to drag the distributor around with it. This motion is transmitted by a linkage to a snubber cylinder. Snubbing action is supplied by forcing oil past a needle valve which ordinarily is opened one-half to three-quarters turn. A relief valve in this piston is set to operate if the needle valve becomes plugged with dirt.

Pneumatic Timers Control Cycle

After a set interval, representing a full load of crystals, a timer cuts off the unloading cycle. Another timer regulates the rinse, and a third sets the spinning time.

Normally, the oil pump, driven from the main centrifugal shaft through worm gears, circulates oil freely to and from an oil reservoir in the base. To start the unloading portion of the cycle, the timer pneumatically closes a valve in the oil discharge line. This causes oil pressure to be applied to the hydraulic lifting cylinder, actuating the unloader piston and causing the knife holder to slide vertically upward. The knife projects substantially the full width of the basket and deflects the layer of crystals within the bowl into a discharge chute. The unloader knife continues to rise, deflecting crystals into the chute, until a limit switch is tripped. When this occurs, the timer is deenergized and a valve in the pump discharge line is opened, thus allowing the pressure to drop and the unloader knife to fall. When the unloader knife reaches the bottom of its stroke it trips the limit switch and the cycle is restarted. There is a small leak hole through the piston to allow trapped air to be removed from the system.

Welded Tips Resist Abrasion

As an illustration of what the above factors contribute to the production of a high output of dried crystals, in the handling of ammonium sulphate a basket that holds only 50 to 55 pounds of crystals per load can produce regularly two tons per hour of finished product with the following cycle: Feed 14 seconds, rinse 6 seconds, spin 17 seconds, unload 8 seconds, total cycle 45 seconds.

Many applications necessitate the handling of corrosive liquids. This liquid is discharged into the casing surrounding the basket, and the maintenance of lead lining or other types of protection has been a considerable expense item in large diameter centrifugals. For a small unit of this kind the casing can be easily cast of stainless steel without excessive expense.

Periphery of large diameter baskets is usually sheet metal, with welded joint, and frequently has reinforcing bands shrunk on. Small diameter baskets are simpler and stronger, being fully machined centrifugal castings of bronze or stainless steel.

It is obvious that when the unloader knife contacts crystals traveling at a high surface speed, the tendency toward abrasion is severe. This is also true of the tips of the cake distributor. In both cases the part is given an edge of stellite, welded on, which minimizes such wear.

In older types of extractors the installation of screens is a particular and rather tedious job, the screen being laid in and wired to the basket wall. Such a screen, is, of course, never entirely flat and would be inadequate for a machine where the unloader knife is

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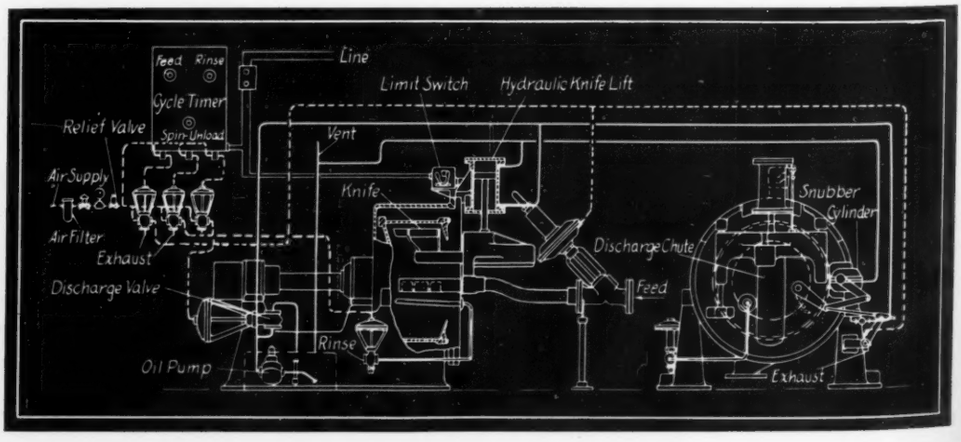

Fig. 4—Schematic cycle control circuit shows method of operation and relation between control elements in extractor

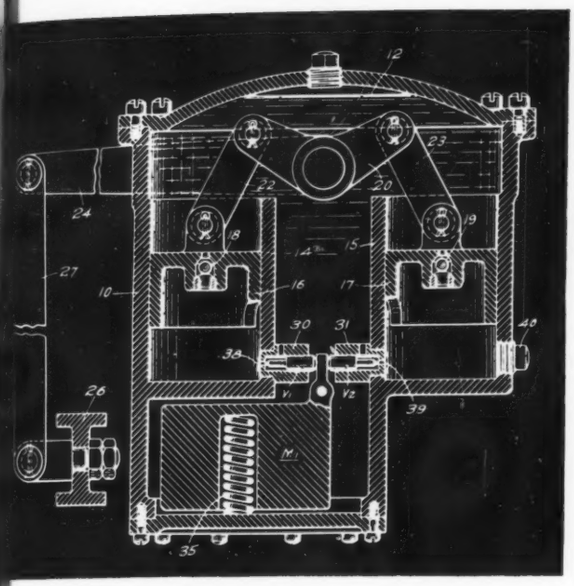

Fig. 1 — Double-acting, inertia-controlled fluid shock absorber involving as elements a fluid chamber, a cylinder, a piston, a valve and an inertia member

Claims Are Vital to Patent Protection

By George V. Woodling

PARTICULARLY addressed to the engineer and designed to help him further his understanding of patent writing, this article deals with the important problem of introducing elements in a claim. Carefully worded examples are given by the author. Seldom if ever before has this involved subject been discussed in terms understandable to laymen

IN DRAFTING a patent claim it is important to set forth a principal element directly or positively before referring to that element indirectly. That is, a part must be listed or introduced before it is referred to with respect to other elements. If this rule in claim writing is observed, ambiguity will be avoided.

These factors and their governing considerations will be discussed in this article, using inventions and drafted claims pertaining to various shock absorbers as illustrations. In addition will be covered the importance of treating elements as positive parts of an invention, instead of as an aggregation, as well as the desirability of avoiding needless restrictions.

As explained in an article dealing with the writing of claims, (M. D. Sept. 1940) the first step in drafting claims is to list the essential elements of the invention.

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In the shock absorber shown in *Fig.* 1 they may be listed, for example, as follows:

1. A low-pressure fluid chamber.
2. A cylinder.
3. A piston within the cylinder.
4. A valve for governing the flow of fluid from the cylinder to the low-pressure chamber.
5. An inertia member for controlling the valve.

In setting forth these elements into a claim, we may proceed:

I claim as my invention:

1. A fluid shock absorber for absorbing energy comprising, in combination, a LOW-PRESSURE FLUID CHAMBER, a CYLINDER, a PISTON within the *cylinder*, a VALVE for governing the flow of fluid from the *cylinder* to the *low-pressure fluid chamber*, and an INERTIA MEMBER for controlling the *valve*.

In Claim 1, for the purpose of this discussion the block type words are used directly and the italicized words indirectly, that is to say, all of the italicized words have been previously set forth positively. In patent language, the block type words are referred to as constituting "antecedents" for the italicized words. Thus, the first occurrence of the word CYLINDER, which is set forth positively, constitutes an antecedent for the second and third occurrence of the word which is used indirectly. The following Claim 2 explains how a claim may read which lacks antecedents (this claim and succeeding ones are numbered consecutively for order rather than relation):

I claim as my invention:

2. A fluid shock absorber for absorbing energy comprising, in combination, a piston within a *cylinder*, and a valve operated by an *inertia member* for governing the flow of fluid from the cylinder to a *low-pressure fluid chamber*.

Claim 2 would not be accepted by the Patent Office

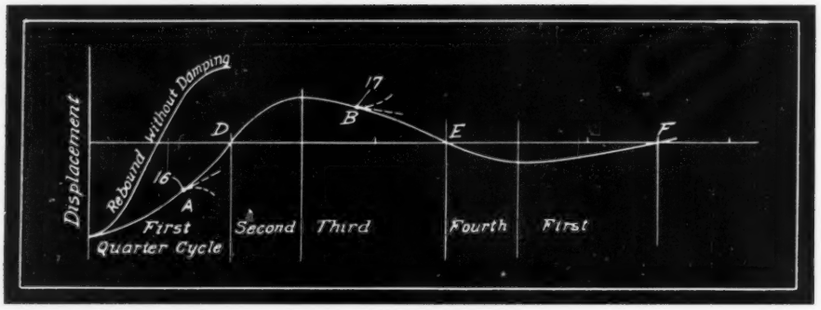


Fig. 2—Operating performance of the shock absorber shown in drawing Fig. 1

because the italicized words have been used indirectly without their having been previously used directly. Thus, the italicized words have no antecedents. The lack of antecedents in Claim 2 may be cured by setting forth the principal elements directly before using them indirectly. In some instances where a claim is rejected by the Patent Office upon the ground that a certain element within the claim does not have an antecedent, the claim may be corrected upon rewriting the portion of the claim involved by using the function performed by the element as a feature to "modify" another recited element. Thus, the portion of Claim 2 which reads: "A valve operated by an inertia member for governing, etc." may be rewritten to read: "An inertia-controlled valve for governing, etc." With the above in mind, claim 2 may be corrected to read:

> I claim as my invention:
>
> 3. A fluid shock absorber for absorbing energy comprising, in combination, a low-pressure fluid chamber, a cylinder, a piston within the cylinder, and an intertia-controlled valve for governing the flow of fluid from the cylinder to the low-pressure chamber.

Introductory Clause Supplies Antecedent

Another way to take care of supplying antecedents is to set them forth in the introductory clause of the claim. The shock absorber must be used between the sprung and unsprung masses of the vehicle, but they are no part of the invention. The question arises in drafting a claim as to how the sprung and unsprung masses may be set forth in the claim without making them a positive part of the claim. If the claim is written as follows, the sprung and unsprung masses become a positive part of the claim.

> I claim as my invention:
>
> 4. A fluid shock absorber comprising, in combination, a SPRUNG MASS, an UNSPRUNG MASS, a low-pressure fluid chamber, a cylinder, a piston within the cylinder, means responsive to the relative movements of the *sprung* and *unsprung masses* for actuating the piston within the cylinder, and an inertia-controlled valve for governing the flow of fluid from the cylinder to the low-pressure fluid chamber.

This claim would be rejected by the Patent Office as constituting an aggregation, because the sprung mass and the unsprung mass is no part of the invention. If the words "sprung mass" and the "unsprung mass" as printed in block type be removed from Claim 4 to obviate making the sprung mass and the unsprung mass of the vehicle a positive part of the invention, then there would be no antecedents for the "sprung and unsprung masses" printed in italicized type in which case the claim would be improper. Claim 4, however, may be cured by introducing the sprung mass and the unsprung mass in the introductory clause. Then Claim 4 would be modified to read, as Claim 5 below:

> I claim as my invention:
>
> 5. A fluid shock absorber for vehicles of the type having a sprung and unsprung mass comprising, in combination, a low-pressure fluid chamber, a cylinder, a piston within the cylinder, means responsive to the relative movements of the sprung and unsprung masses for actuating the piston within the cylinder, and an inertia-controlled valve for governing the flow of the fluid from the cylinder to the low-pressure fluid chamber.

Minor Parts May Be Introduced Indirectly

If an element is considered as a minor or sub-part feature of a principal element, then it may be introduced indirectly. The valve in the shock absorber has a "seat" and a "plunger" which may be considered as sub-part elements and may be expressed in a claim indirectly. The following Claim 6 is evolved from Claim 3 by introducing the sub-parts indirectly.

> I claim as my invention:
>
> 6. A fluid shock absorber for absorbing energy comprising, in combination, a low-pressure fluid chamber, a cylinder, a piston within the cylinder, and an inertia-controlled valve having a *seat* and a *plunger* for governing the flow of fluid from the cylinder to the low-pressure chamber.

To be patentable, a claim must not "read on" a prior device. It should be kept in mind that a claim reads on a prior device if the prior device contains elements which satisfy the claim. Thus, Claim 3 reads on the shock absorber in *Fig.* 3, which we will assume is a prior device, because this shock absorber has the same elements as listed for *Fig.* 1.

Difference Provides Patentability

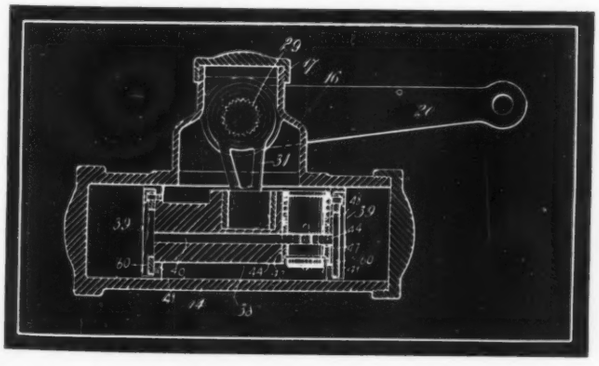
Therefore, if the Patent Office rejects Claim 3 as reading on the prior device in *Fig.* 3, the applicant may either contest the holding of the Patent Office or amend or write new claims. In amending or writing

new claims, the attorney for the applicant of the invention in *Fig.* 1 compares the two shock absorbers to determine if he can find any features in the shock absorber of *Fig.* 1 which do not exist in the shock absorber of *Fig.* 3. In other words, a "difference" is sought between the two devices. This difference then is set forth in words and inserted in the amended or newly written claims to prevent them from reading on the prior shock absorber. In comparing the two shock absorbers, it is noted that the valves of the shock absorber in *Fig.* 1 are of the poppet type and thus the closing and the opening of the valve are affected by the fluid pressure, whereas the inertia valve in the shock absorber of *Fig.* 3 is of the sliding type and the closing and the opening thereof are not influenced by the fluid pressure. The function of a poppet valve as distinguished from a slide valve constitutes a difference between the two shock absorbers. By inserting this difference in Claim 3, we obtain Claim 7, which does not read on the prior device.

> I claim as my invention:
>
> 7. A fluid shock absorber for absorbing energy, comprising in combination, a low-pressure fluid chamber, a cylinder, a piston within the cylinder, and an inertia-controlled *poppet type of valve* for governing the flow of fluid from the cylinder to the low pressure chamber.

Avoiding Needless Provisions

In amending and writing new claims care must be exercised to avoid inserting needless provisions in the claims in order to obtain their allowance by the Patent Office. It is these needless provisions in a claim which makes it easy for a competitor to design around them. A competitor may easily avoid infringement of such



claims by constructing his device so as to omit at least one of the needless provisions.

If an applicant, in order to obtain the allowance of a claim, which stands rejected by the Patent Office as reading on a prior device, restricts the scope of the claim by inserting qualifying words or phrases in the rejected claim to exclude the prior device, he cannot, after the claim is once allowed, contend that the claim be interpreted as if the qualifying words or phrases were not present. This attempt to enlarge the scope of a restricted claim after it is once allowed by the Patent Office is discussed in many decisions, of which the following is representative:

> "The case, in our opinion, thus calls for the application of the principle that where an applicant for a patent to cover a new combination is compelled by the rejection of his application by the Patent Office to narrow his claim by the introduction of a new element, he cannot after the issue of the patent, broaden his claim by dropping the element which he was compelled to include in order to secure his patent.
>
> "If dissatisfied with the rejection he should pursue his remedy by appeal; and where, in order to get his patent, accepts one with a narrower claim, he is bound by it.
>
> "Whether the examiner was right or wrong in rejecting the original claim, the court is not to inquire.
>
> "The applicant having limited his claim by amendment and accepted a patent, brings himself within the rules that if the claim to a combination be restricted to specified elements, all must be regarded as material, and that limitations imposed by the inventor, especially such as were introduced into an application after it had been persistently rejected must be strictly construed against the inventor and looked upon as disclaimers.
>
> "The patentee thereafter is stopped to claim the benefit of his rejected claim or such a construction of his amended claim as would be equivalent thereto."

Needless Provisions Aid Competitors

The same reason applies to cancelled claims. Thus, when the applicant once cancels a claim it is gone forever. He can never reclaim that which has been relinquished to the public.

An example of a needless provision may be found in Claim 8 directed to the fact that the flow duct in the shock absorber in *Fig.* 3 extends through the piston from end to end. Claim 8 reads:

> I claim as my invention:
>
> 8. A shock absorber comprising, in combination, a cylinder, a piston therein adapted to form liquid chambers between opposite ends thereof and the opposite ends of the cylinder, a flow duct arranged to connect said chambers and *extending through the piston from end to*

(*Concluded on Page* 104)

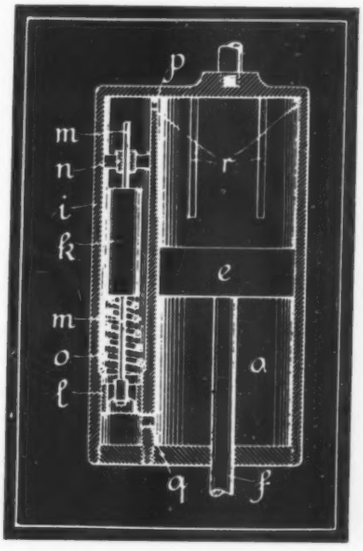
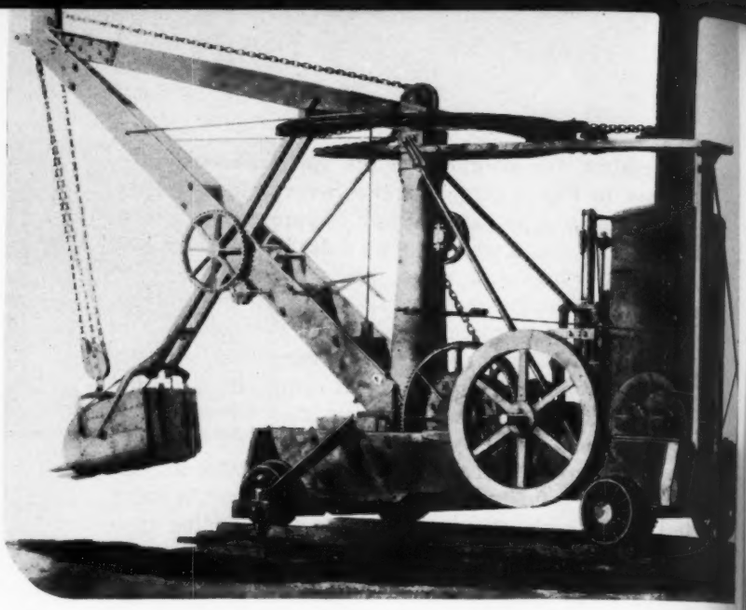


Fig. 3—Left—This invention and that shown in Fig. 1 are patentably different. Although elements are the same, valves differ in that one is sliding and the other is poppet

Fig. 4—Right—Flow duct is through cylinder casing avoiding infringement with Fig. 3 which has duct in piston



DESIGNED over one hundred years ago, by William S. Otis, the first power shovel illustrated at right utilized steam power for propulsion, boom swing and crane hoist. Chains served both as gearing and cable. Shovel crowd was manually operated by a crank with gear and chain rack. Structural parts including chassis, mast and boom were wood.

Dipper had a capacity of 1¼ cubic yards and was a square iron box with a strong wood handle. To provide overload protection, the inventor applied a friction wheel on the windlass that would slip should the shovel strike a large rock or other obstruction, thus protecting the machine.

Power Shovels Typify Machine Progress

As motive power for shovels the steam engine was still used in 1919. Developments, however, included corrugated operator's cab and crawler traction as shown at left. This machine was one of the first crawler-mounted units and was a great advance over intervening designs. Materials utilized were a far cry from the wood members of the first shovel. Riveted fabrication provided a sturdy, capable machine. Crowd as well as all other functions had become power controlled by levers within the cab. Weight was between 54,000 and 65,000 pounds depending on equipment.

Photos courtesy Lincoln Arc Welding Foundation

Today shovels have the benefit of styling for appearance as well as utility as evidenced by the Bucyrus-Erie model at the right. Operator's cab is fully enclosed and diesel power, in the model illustrated, has replaced the steam engine. Lubrication is mainly automatic. Arc-welded fabrication is utilized together with carefully chosen alloys, annealing and heat treating to give strength and toughness to the shovel members. Increased strength-weight ratios are thus achieved, permitting higher pay loads in the dipper.

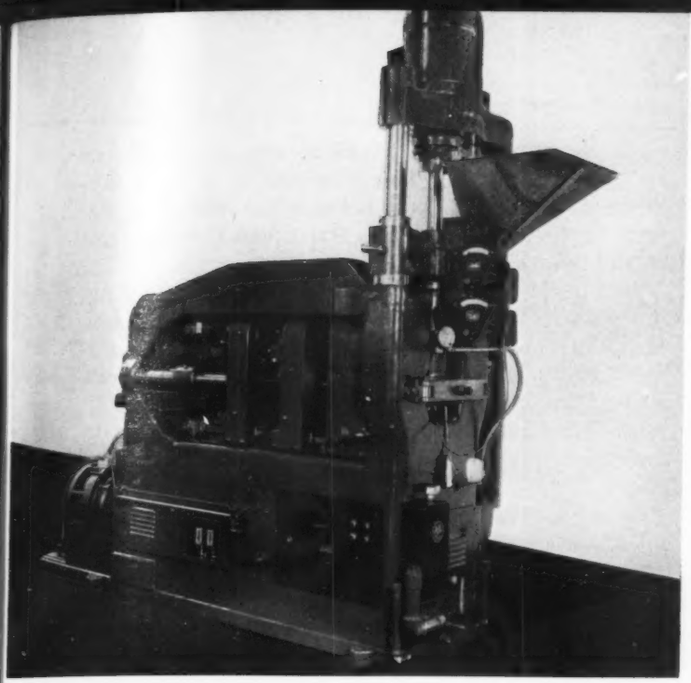
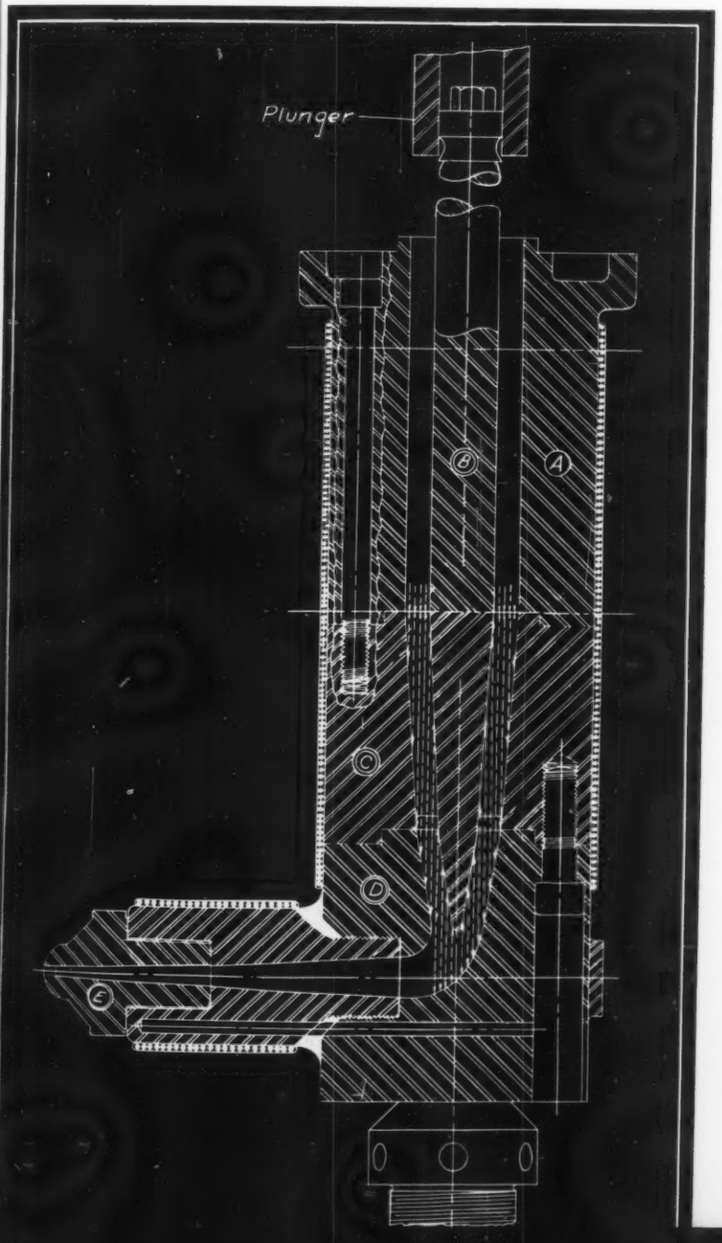


Fig. 1—Injection molding machine utilizes chilled mold and hence is adapted to casting thermoplastic materials

Fig. 2—Below—Heart of all injection molding machines, the chamber in which powder or granular material is plasticized



Beam Frame Is Key to Injection Molder

By W. H. Schwartz
Lester Engineering Co.

MACHINES for injection molding of plastic materials came into demand in this country about six years ago, when it was found that compression molding was often uneconomical for costly thermoplastic materials which will not set until cooled. In contrast to compression molding, injection molding utilizes a chilled mold. One of the latest models of injection molders is the Lester machine in *Fig.* 1, which embodies several design innovations.

Original powder or granular material is poured in the hopper at right and broken down in the vertical plasticizing chamber, from which it is pushed by a plunger through a restricted orifice into the mold sprue and then into the mold die cavities. This chamber is divided into three main sections, shown in *Fig.* 2: Section *A*, a hollow cylinder; section *C*, the spreader section consisting of a number of equally spaced holes drilled longitudinally to the axis of the spreader; and section *D*, consisting of a cone-shaped passage where the spreader holes gradually converge into an elbow and continue to section *E*, the nozzle. Section *B* is a shaft concentric to cylinder *A*, permitting a uniform annular ring of material throughout the length of *A*.

In operation, granular material is led into the annular chamber between *A* and *B* in which it is first preheated from electrical resistance heat-

ing collars contacting the outside surfaces of the sections to be heated. A plunger descends by hydraulic actuation and the material is forced into the spreader section *C*, where the semiplasticized material is spread equally within itself and is subjected to more heat. Previously plasticized material is then displaced from section *C* to *D* to *E*, and from *E* into the cavity of the mold.

To eliminate the "holding" temperature of the mass of material which lies in the converging elbow, the surfaces of section *D* are not insulated or heated, permitting excessive heat to be radiated. Otherwise plasticized material might burn or decompose. Plasticity is maintained beyond the elbow, however, by additional heating collars.

The pressure required by the plunger depends on the resistance of the material against the contacting surfaces. The design of the annular passage formed by *A* and *B* and the convergence of the spreader holes aid natural flow and minimize resistance. Therefore a greater percentage of the total applied pressure is utilized in molding the material in the die.

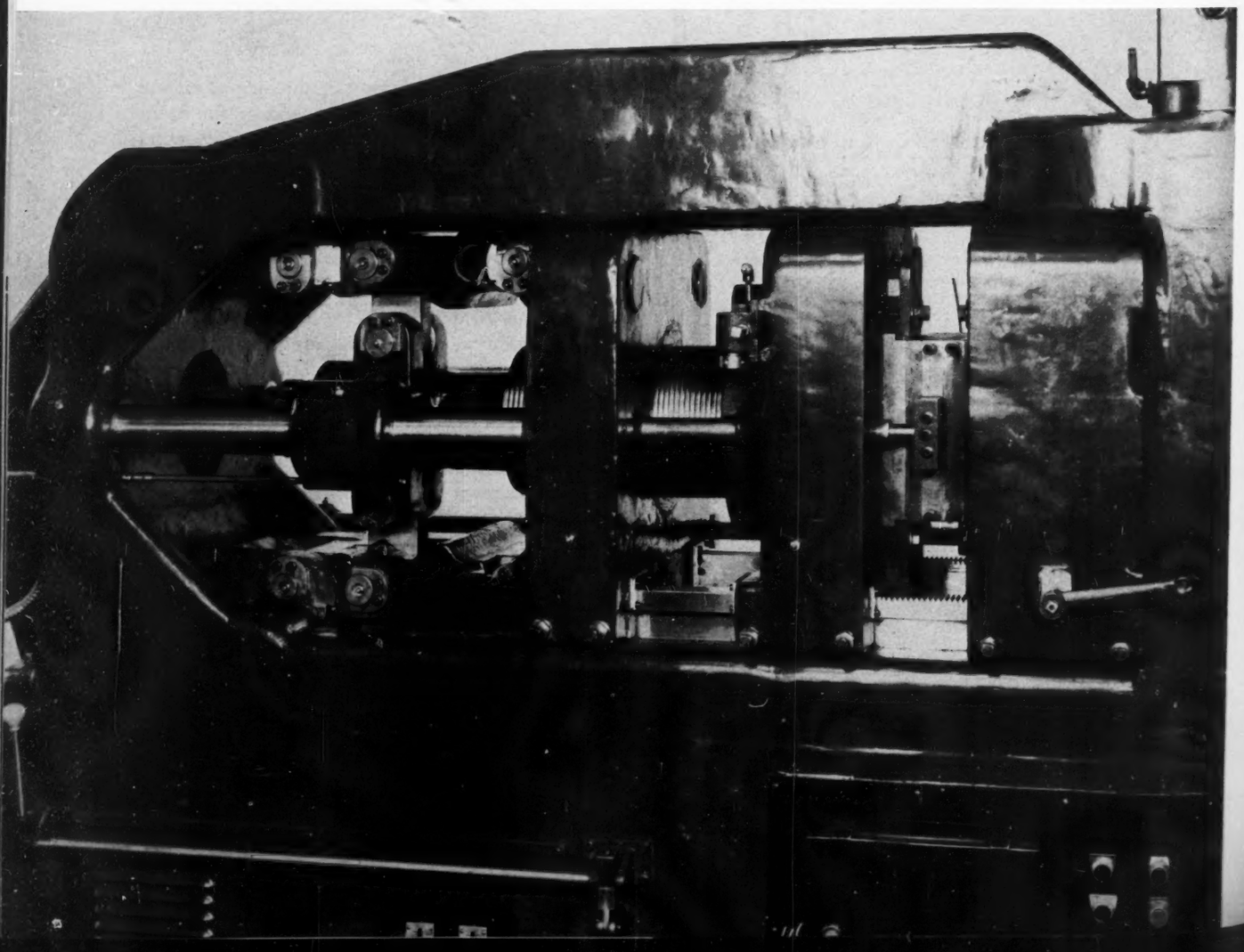
In the Lester machine, pressure averaging 25,000 pounds per square inch is developed in the die cavities, necessitating a mold locking mechanism of sufficient size and locking power to resist the pressure within the die. The frame of the machine must be preloaded by locking the die before each shot. Die locking pressures range from zero to 500 tons.

The machine frame consists of heavy cast steel top and bottom beams joined to the end members, as shown in *Fig.* 3. This construction permits full utilization of the die space between the beams. Cross sectional area of the beams illustrated is equivalent to 180 square inches.

During the preload period of the beams on locking the dies, and during the period of injection of material into the die cavities, the joints where beams meet end members are subjected to a high shear stress. The shearing area is based on a factor of safety of 15 to 20, and accuracy of parallelism is maintained by the frame during the life of the machine.

Fig. 4 shows, in the open position and in the closed ultimate pressure position, the double-toggle link mechanism used to actuate the die plate movement. It is primarily actuated by an hydraulic cylinder which in this case moves over a stationary piston. Examination of the cross section and of *Fig.* 3 will show the toggle link utilized is a combination of a toggle link intensifying its pressure to another toggle link which in turn multiplies this force to the component members of the machine. The pressures applied to the entire machine frame are equally and centrally divided, and are called the preload pressure from which the rating of the press capacity is determined.

Fig. 3—Heavy top and bottom beams joined to end members comprise frame of the machine, permitting full utilization of the die space between beams



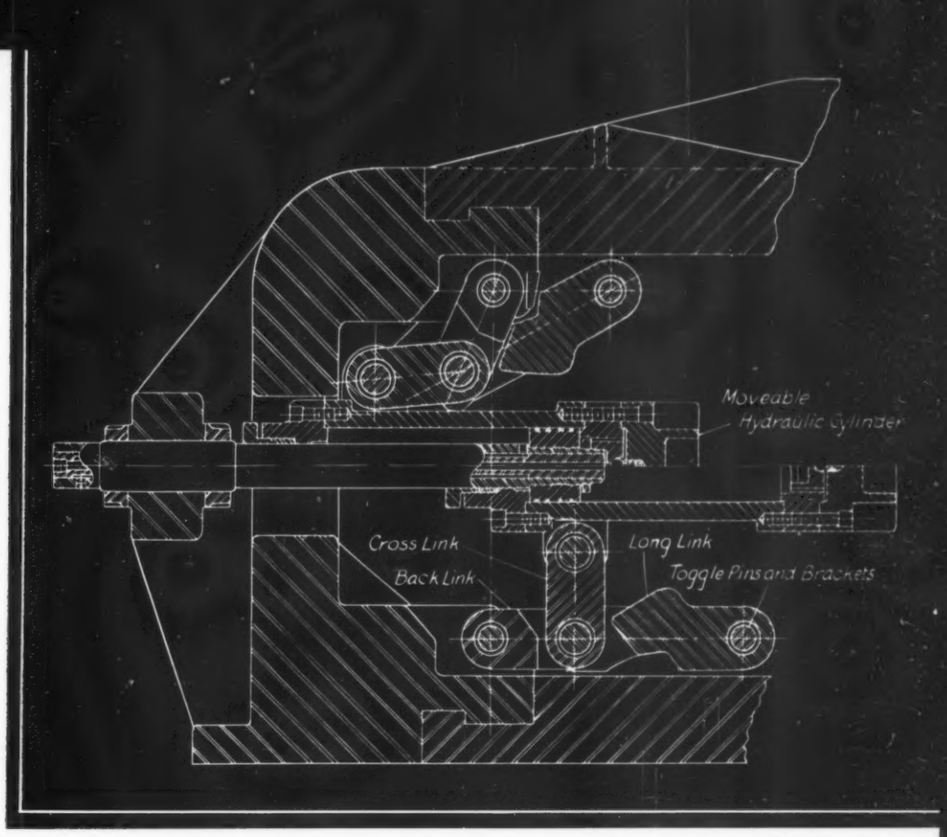


Fig. 4—Double-toggle link mechanism actuates die plate movement. It is shown in open position and in closed ultimate pressure position

On preloading the machine frame, the resistance of the frame holds the die molds from opening when material is injected into the mold cavities. Before the mold can open even slightly, the pressure applied and multiplied against the effective surfaces of the die must exceed the initial preload pressure applied to the machine frame. If the injection pressure surpassed the preload pressure, the beams of the machine frame would stretch in proportion to its length, area, and amount of exceeded pressure during the molding cycle. As explained previously, the cross sectional area of the beams that are subjected to preloading and molding pressures is figured with a factor of safety of from 15 to 20, in accordance with the elastic limit of the material. Alloy steel of the chromium-molybdenum type with high elastic limit and ultimate strength is used for machine members and for the double-toggle link mechanism.

Toggle Pins Protected

Protection of toggle pins and bushings from sudden shock loads is provided by the use of link locks and knuckle joints on the long link. When the long link is in locked position, the link locks and knuckle joints coincide with component parts on the end member and the movable die plate. Formerly the toggle pins and bushings were subjected to shock as well as steady pressures during any single cycle of the machine. This fact made necessary the use of a very large toggle pin and bushings, but even this arrangement was unsatisfactory during constant use of the machine.

Any pressure that may exceed the preload pressure on the machine frame is now absorbed in the link locks, knuckle joints, long link and frame of the machine. Toggle pins and bushings are subjected only to the preload pressure, which is a steady build-up and not a shock load. Faces of the link locks are automatically greased and oiled during opening and closing movements. These links also serve to maintain constantly an accurate four-corner lock, keeping the die in perfect alignment during operation.

An important factor in injection molding machine design is interchangeability of various dies of different shapes and thicknesses, permitting mounting them in, between and on the machine die mounting plates. In order to receive full benefit from the mechanical advantage of the toggle link, the die must be closed and the toggle links be in a pretermined position—that is, that position of the link after the die is closed. The links are then finally brought to the dead center locking position, during which movement they stretch the machine frame and overcome the resistance of the frame equivalent to a pressure required to maintain the die closed during the injection period.

To insure that the exact predetermined locking position of the toggle link is reached regardless of the size of die, the machine utilizes an intermediate plate on which the movable half of the die is mounted, adjustable from the end plate on which each of the toggle links is joined. *Figs.* 3 and 4 illustrate this construction. The intermediate plate is adjusted by a worm shaft rotating a wormwheel integral with a cylindrical adjusting screw mounted in the intermediate plate. This screw is large in diameter and keeps the intermediate plate from misaligning from the end plate. Acme thread is used, designed with sufficiently large pitch to resist the preload pressure to which it is subjected. This central adjustment permits use of the permanent beam type machine frame.

All of the electrical and hydraulic controls of the machine are enclosed in a welded base. Openings on the sides, covered by louvre plates, provide easy access for parts maintenance.

How Shot Blasting Increases Fatigue Life

By F. P. Zimmerli
Barnes-Gibson-Raymond Div.

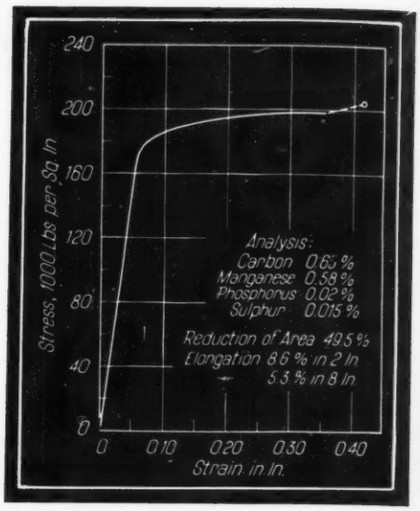


Fig. 1—Stress-strain curve for valve spring wire, heated to 750 degrees Fahr. after coiling but not pressed

SHOT blasting has done more to increase fatigue life of our small springs than any of the alloy steels ever used. This statement is based on tests conducted on a large number of springs, most sizes being less than ¼-inch in diameter, although some were up to ¾-inch.

In the investigation the first runs were made to study effect of time of exposure to shot blasting, with all other conditions held constant. It was appreciated that this factor was of prime importance and would vary somewhat with each type of spring and method of treating. A bundle of valve spring wire was selected, size .162-inch, for these tests. Physical properties of this wire and its chemical analysis are shown in *Fig.* 1. The springs were 1-7/32-inch outside diameter, 3¾ active coils, 1⅞-inch free length, ends squared and ground. They were heated to 750 degrees Fahr. after coiling and of course were not pressed. Fatigue range before shot blasting was 20,000 to 95,000 pounds per square inch. The astounding results of the shot blasting are shown in the results presented in *Fig.* 2. Maximum stress has increased in this test about 42 per cent, a greater increase than any other known treatment even approaches.

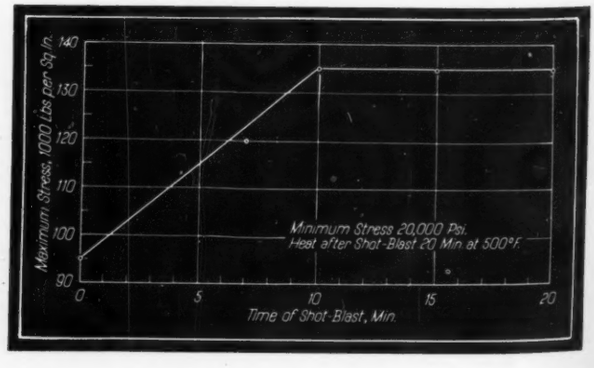
In the commercial shot blasting of small springs the duration of the treatment is a function of the number. When too many springs are put in any machine, mechanical or air type, they will not be properly treated. Exact details depend on the machine and type of work and can be determined only by experiment.

What causes this increase in life and what affects it? More of the springs were properly blasted and heated afterwards to various temperatures, with the results shown in *Fig.* 3. At 825 degrees Fahr. we have the same stress range, 20,000 to 95,000 pounds per square inch as before the blasting. In other words, this heating has removed the beneficial effect of the shot blasting which apparently was nothing but cold work of the outer fibers. Reblasting will reproduce the same high fatigue resistance.

Effect of size of shot was investigated, using shot 1/64 and 3/64-inch in diameter, amounting to a difference in shot volume of 27 times. But the same type of wire gave the same fatigue limit with either shot size, with one slight exception. Springs set high enough in stress range to break ran longer when blasted with the small shot. When larger spring wire was tested, however, results were a little better with heavier shot.

Material in a straight section was carefully polished with jewelers' rouge of the same grade as used to prepare metallographic samples. This was tested and found to have a torsional fatigue life less by far than the blasted springs gave. Further testing indi-

Fig. 2—Maximum stress in wire has increased 42 per cent after shot blasting. Effect of time of shot blast is evident



From a paper presented at the Twenty-second annual convention, ASM.

cated that wire can be produced and blasted so that the resulting compression spring is self-protecting. This is done by proper heating after coiling so that the spring if overloaded will set to a load corresponding to a stress the material will withstand. This spring will then give, so far as our testing is concerned, infinite life.

A rough surface, it was found, is not a sure cause for spring failure, and even springs with surfaces pitted by shot blasting have a greater fatigue life than those with a normal smooth surface. This result is undoubtedly obtained in spite of, and not because of, the roughness.

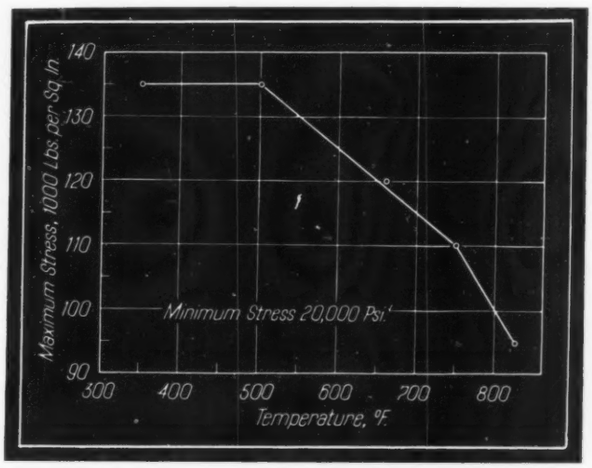


Fig. 3—Heating has removed the beneficial effect of shot blasting. Reblasting will reproduce high fatigue resistance

Unfortunately much material used is not perfect. Tests were run on slightly decarburized wire. As received and tested with no blasting this wire was more than 5000 pounds per square inch below the normal fatigue range, the value taken for this steel being 20,000 to 88,000 pounds per square inch. Springs were shot blasted and found to have a fatigue range of 20,000 to 115,000 pounds per square inch, a loss due to the ferrite of 20,000 pounds per square inch after blasting.

In this case, however, the springs that broke because of overstressing lasted longer when heavier shot was employed in contradiction to the experience with good wire of the same size. This indicates that poor wire cannot be improved as much as sound material. The comparative results between large and small shot on this steel are logical if one pictures the larger shot carrying enough energy to cold work the steel through the decarburized surface. On the better steel this was not necessary. The small shot which cold-worked sufficiently and roughened less was the better until larger wire with lower tensile strength was used. Then the larger shot began to have more effect.

Experiments with softer shot or shot that was heated to reduce its hardness gave on sound wire the same fatigue values despite the fact that the surface appeared smoother. Examination under the binocular microscope showed enough larger pits from the blasting so that, despite the visual appearance, the surface itself was not for practical purposes very much altered.

Tests on springs made of defective wire show that no improvement results from shot blasting if seams or hairlines are present. On wire that is badly gouged, either by the wire maker or the spring producer, shot blasting apparently has not reduced stress concentration or increased life to any great extent. With scratches round enough at the bottom (as most mechanical scratches are) a normal increase in endurance was obtained by shot blasting. Scratches up to ¼ of

TABLE I

Material of Spring	Normal Stress Range lbs./sq. in.	Shot Blasted Stress Range lbs./sq. in.
Valve spring wire.....	20,000 to 95,000	20,000 to 135,000
Music wire S.A.E. 1095....	20,000 to 90,000	20,000 to 135,000
Electric furnace	20,000 to 90,000	20,000 to 135,000
18-8 Stainless	20,000 to 65,000	20,000 to 110,000
13-2 Stainless	20,000 to 80,000	20,000 to 120,000
Phos. bronze S.A.E. 81....	20,000 to 35,000	20,000 to 50,000

1/1000-inch deep can be removed, but except for this and the improved looks of the part, no shot blasting is of help. The process will not be a cure for either defective steel or manufacturing methods.

As a result of years of testing we believe that on wire sizes less than .207-inch, TABLE I shows the effect of the shot blasting accurately. Use of the highest stresses is not advised because the springs will set, or lose load to some extent, depending on the temperature to which the springs are exposed. No runs were made at temperatures above atmospheric and few tests were continued beyond ten million cycles. On phosphor bronze or nonferrous metals with indefinite fatigue ranges this must be considered in design. TABLE I is based on using .148-inch wire.

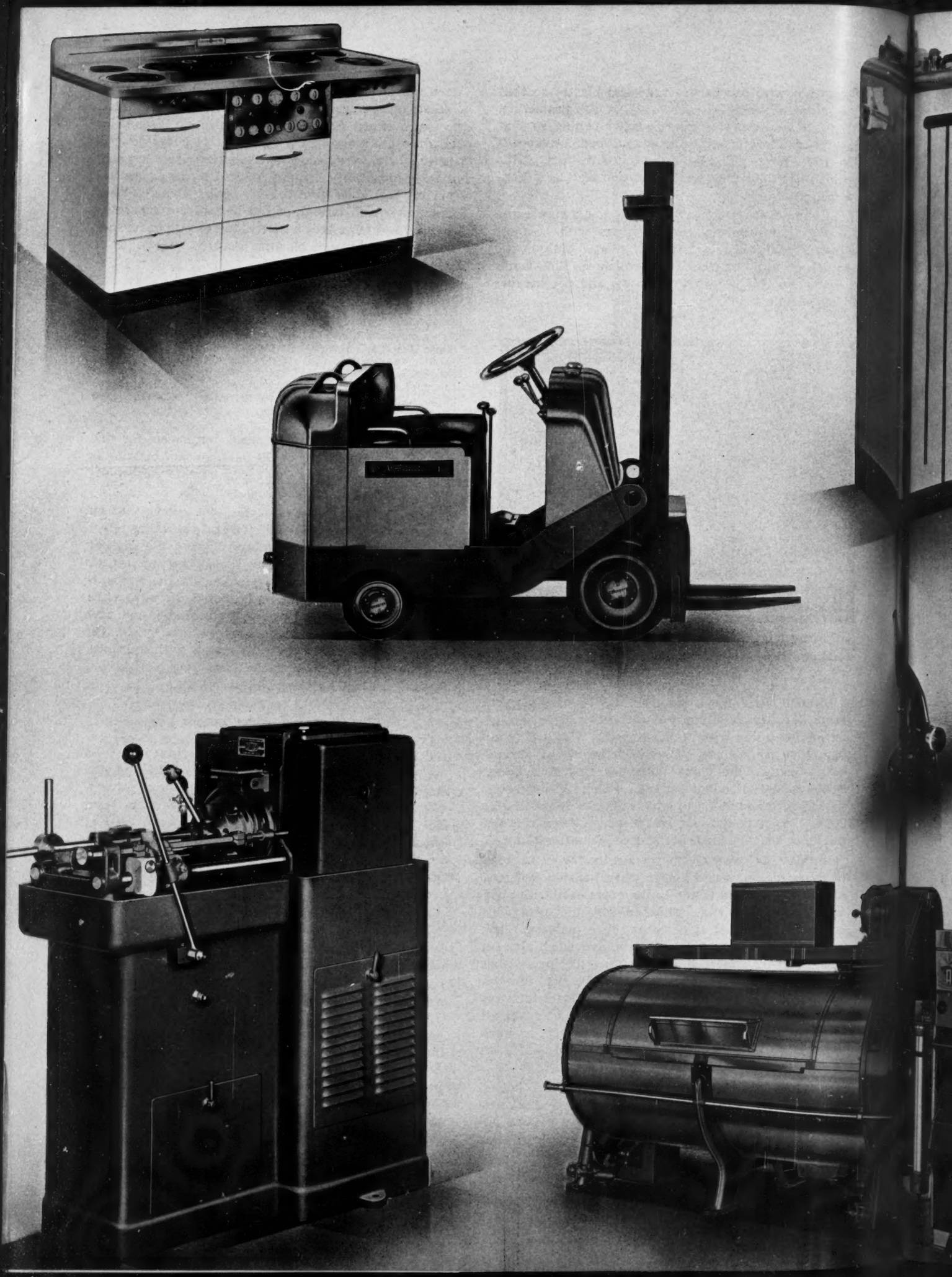
Shot Blasting Provides Longer Life

On wire sizes larger than 7/32-inch, gains have been made in the endurance of the springs, although the stress range does not increase in as great a percentage. These springs have in the most part no great call for a real endurance range. They are used at stresses which will break them in time, but the number of stress applications in the life of the unit is less than they will withstand.

Thus, by shot blasting, coiled automotive chassis springs may now be designed up to the elastic limit since trouble will be encountered not by breakage but by loss of load due to the spring not returning to its original length. In 1934 this was not so; springs were stressed lower to avoid breakage since shot blasting machines were not designed to handle these springs.

It must be realized that the increase in life of the part may be increased several hundred per cent with but a small percentage of increase in fatigue life.

This article has dealt with coiled springs, but the process can be applied to many parts. Thus in clutches using Belleville washers the shot blast has provided safety never before enjoyed. It may be used on torsion bars, base of gear teeth, axle shafts, in fact any highly stressed part if the surface does not need to be exceptionally smooth.



Design Features IN NEW MACHINES

(For new machine listing see page 128)

THIS MONTH'S COVER. Giant Kippcaster utilizes a combination of hydraulics and pneumatics, whereas other Kipp die casting machines are pneumatic. The diehead ram is operated hydraulically through a toggle arrangement. Metal is "shot" by a displacement plunger operated by a pneumatic cylinder. Frame castings are high strength iron, as are the metal pot and gooseneck. Power parts are heavy cast steel

One-piece top and backsplasher of General Electric range (left, top) is monel, while remainder is white porcelain enamel. Styled by Ray Patten, the range has a large control panel in front with five-speed switches for six surface heating units. These Calrod units have a stainless steel ring overlapping the cooking top and a one-piece aluminum cupped pan beneath

Per cent concentration of any colored substance is read direct without calculation on Spencer Colorimeter (center, right). Light travels from cups holding liquid to biprism at neck of eyepiece tube and is then resolved into three rays which pass through triple aplanatic lens and thence to eyepiece. Illuminator is built into base. Finish is black enamel, chromium trimmed

Double-acting type beater in Lorac Freez-King (right, bottom) is heavy cast dairy metal and is driven by large-ratio V-belt from motor. Entire freezer head is stainless steel and dairy metal and is mounted on a stainless steel panel extending from bottom front of cabinet up over top. Sides and back are rustless iron

Powered by a twenty-two-horsepower gasoline engine, the Towmotor truck (center, left) has two speeds forward and two reverse, but the transmission has only four gear elements. Lifting and tilting system is hydraulic. Front (driving) axle housing is designed as an integral part of frame, insuring proper alignment of axle with transmission and engine. Frame is arc welded

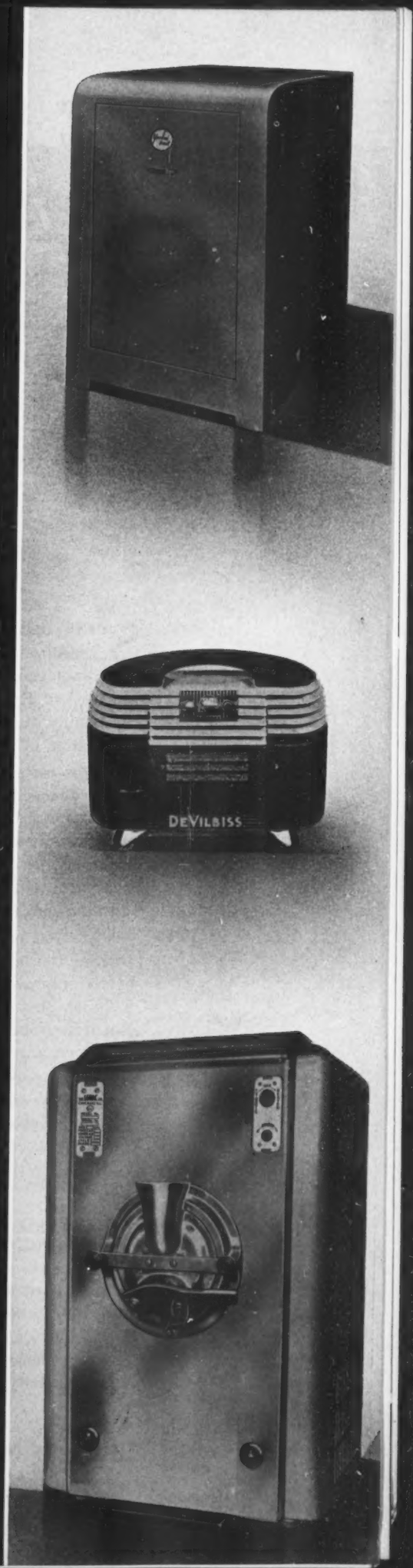
Motor totally enclosed in base of the Oster bolt threading machine (left, bottom) drives both spindle and oil pump by vertical V-belts, a worm gear transferring power from driveshaft to spindle. An oil level sight gage facilitates keeping oil at proper level. Base is all-steel, generously braced for strength and rigidity

Staggered boiler tubes provide maximum heat extraction in York oil-burning boiler (right, top) which is thermostatically controlled. Combustion chamber is cast in one piece. A fully enclosed, insulated jacket of gray-finished furniture steel is provided. Cast iron boiler and special oil burner are co-ordinated

Mechanical Washman shown at right of the Norwood Cascade washer (center, bottom) automatically performs every phase of washing process. It has a circular disk with perforations which indexes at half-minute intervals, a line of plungers descending on the plate. If a plunger passes through a perforation it operates a small relay air valve, permitting compressed air to flow to an air-operated mechanism on the washer. All metal parts of the washer touching clothes are monel, all castings are meehanite

DeVilbiss air compressor (right, center) consists of two single cylinder compressors, one connected to each end of one-half horsepower motor. Large area of exposed fin surfaces provides proper cooling. Cast aluminum housing includes large pulsation chamber, finished in two colors. Crankcase breathers are designed to prevent oil leakage if compressor is overturned

Hartman Yeast-O-Lator (center, top) for putting yeast into baking solution uniformly has stainless steel agitator shaft with monel agitators. Motor shaft packing gland is also monel. Top and lid are polished aluminum and trim is stainless steel. Housing is welded sheet steel finished in white acid-proof enamel



MACHINE DESIGN

Editorial

Newer Production Methods To Play Big Part in Preparedness

SPEED and more speed will become increasingly essential as our national preparedness program swings into higher gear. This applies particularly to development and production of war equipment and the machinery for its fabrication. Regardless of election results, bottlenecks, red tape or other factors, the handwriting on the international wall is too plainly evident to permit any retardation of defense activities.

Few better ways present themselves of achieving the necessary increased tempo of mechanical production than the interchange of ideas always apparent at metal and machinery expositions and allied meetings. At the recent Metal congress, for instance, numerous papers were delivered covering progress in the development and use of metals, and many of the newer types of manufacturing equipment and methods were demonstrated at the exhibition held in conjunction with the congress.

It's too bad that even more designers and production men are not in a position to attend these expositions and to observe the results obtainable by some of the improved methods of production such as resistance welding, injection molding, shot blasting to improve fatigue properties, powder metallurgy, etc. Rapid increase in application of such methods will unquestionably take place as industry moves forward.

New applications of metals and alloys also must be expected, as well as the substitution of certain materials for others not so readily available due to wartime restrictions. Whether the United States enters the war or not there is need for progressive thinking and aggressive plans to put individual companies, industry in general, and the country as a whole in the most advantageous and strategic position.

MACHINE DESIGN is in the fortunate position of having been able to cover, in last month's issue and in this, many of the developments disclosed at the Metal show and congress. In the current number attention is drawn to the design and operation of machines for flash welding and injection molding, as well as to the use of the shot-blasting process for improving the properties of materials. Other developments will be discussed in MACHINE DESIGN for November to give a comprehensive picture of current trends, keeping in mind the possibility of future activity throughout the country on a scale never before experienced.

Nation Needs Designers—

Here's Suggested Training Course

By A. R. Stevenson Jr.

and J. E. Ryan

TENTATIVE government plans calling for training of men specifically for design work in connection with defense have re-emphasized the pressing national need for designers. Inasmuch as the program would involve training men from colleges and mechanics already engaged in manufacturing, industry will be called upon to co-operate closely. Hence this discussion of the training program in effect at the General Electric Co. is particularly timely and interesting

MECHANICAL design may be considered perhaps more of an art than a science, requiring a trained, imaginative mind. More often than not the really ingenious designers of today are men who have come up through the shop and drafting room. With a wealth of first-hand experience with mechanisms and manufacturing processes, they are able to conceive bold, original designs without the necessity of mathematical analysis before venturing to put them on paper. Analysis, of course, is needed more than ever, but in its proper place.

What, then, can be done to foster design ability in young engineers? The creative flair must be born in a man but it remains for schools and colleges to detect this undeveloped ability and give it proper exercise and encouragement. Neither of these functions has been given sufficient attention in our engineering colleges, and whatever ingenuity a man may possess is often so deeply buried under a four-year layer of erudition that it takes years for it to reappear, if ever. To make matters worse, the lack of emphasis on the scope and importance of design engineering during undergraduate years has caused many college students to look upon a designer as a routine draftsman, so that really good men may shy away from design.

Creative Ability Hard To Measure

Discovering creative ability and originality is not an easy task. Whereas ability in mathematical analysis can be measured quite accurately by a conventional examination, a satisfactory index of creative ability is much more difficult to obtain. Several good aptitude tests in mechanisms and spatial visualization have been devised but the authors believe that they are only partial measures. Boyhood hobbies and interests, when honestly expressed and appraised, are one of the best guides. Second only to creative hobbies as an indicator is familiarity with the construction and operation of a variety of machines. This is based on the theory that a man naturally becomes familiar with the things that are vitally interesting to him.

Engineering colleges can do much to encourage the creative ability of students by allowing them greater latitude in the selection and furtherance of machine design course projects. Arrangements should be made to permit at least the more promising students to construct these or other projects of their own in the college shops. Each industry must continue the education of its young engineers along its own specialized lines, whether formally or informally. If creative ingenuity itself cannot be taught directly, at least the embryonic designer can be thoroughly familiarized with up-to-date engineering materials and manufacturing methods.

Three years ago the General Electric company founded its mechanical design course to give such training to a small selected group of young engineers after their first year of employment. These are drawn from electrical as well as mechanical engineering graduates, the prime requisite being a quality of mind rather than previous training. The training program consists of (1) actual experience in design through a series of varied assignments, and (2) instruction in materials, manufacturing processes and engineering analysis in the classroom and factory.

Over a period of approximately a year, each man works in three or four departments in turn, one of

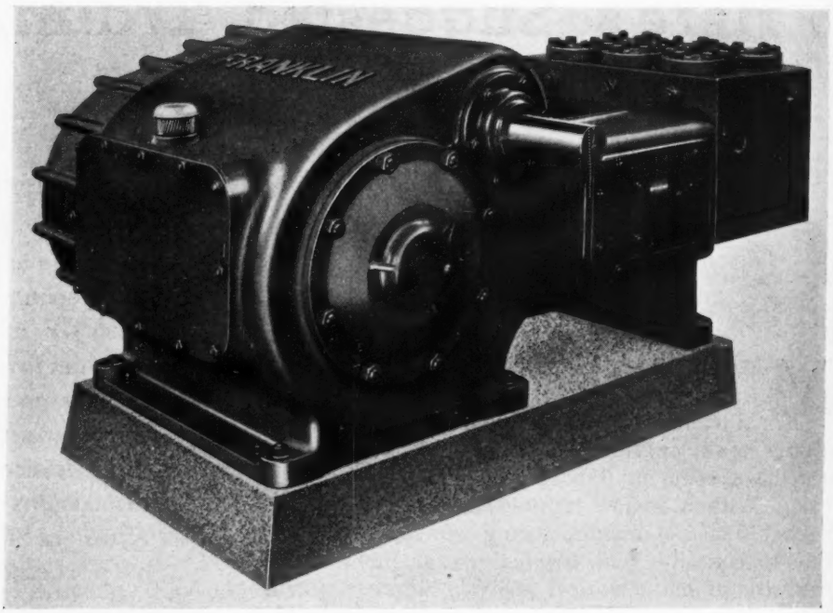
(*Concluded on Page* 122)

From a paper presented at the semiannual meeting, ASME.

Applications
of Engineering Parts and Materials

Pump Has Stainless Plungers

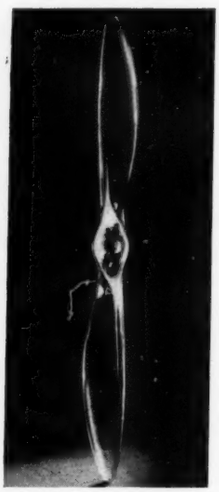
HARDENED stainless steel plungers operating through bronze lined screw type packing glands feature this triplex plunger pump designed for a maximum operating pressure of 1800 pounds per square inch. These plungers are thus not only corrosion resistant but also impervious to abrasion by sand as well as scoring by the metallic packing. The three cylinders in which the plungers operate are bored in a solid forged steel cylinder block. Made by the Franklin Engine and Manufacturing Co., the pump is for oil field service.



Stainless steel contributes toward maintenance-free operation in this triplex plunger pump

Propellers Molded of Plastic

EXEMPLIFYING the spectacular achievements possible with injection moldings of plastics, this propeller for model airplanes possesses many advantages of plastics over wood fabrication. Molded of tenite, which because of its homogeneity and dimensional stability provides excellent dynamic balance, the propellors, manufactured by Arrow Plastics Co., have high impact strength and resilience. These qualities of the plastics are rarely called upon to this extent.



Advantages of plastic are utilized in this model airplane propeller shown at left

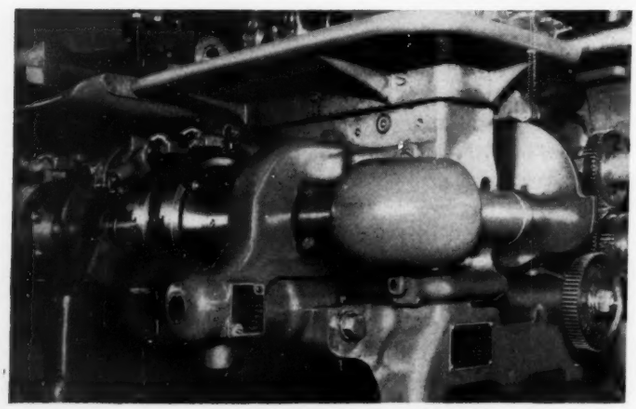
Cams Permit Short Automatic Runs

LAMINATED phenol formaldehyde synthetic resin sheet, long used for cams because of their quiet operation, has, in this application in an automatic screw machine, the additional advantage of quick change over. Because of the ease with which these cams can be cut on an ordinary wood cutting band saw, automatic screw machines can be economically set up for short runs for which automatics were not previously considered.

The cams installed on the Brown and Sharpe automatic screw machine shown in the illustration (left) are synthane. While these cams are used for short runs, runs of four and a half million pieces have been recorded.

Facility with which machine parts may be fabricated from sheets, rods and tubes of these thermosetting resins is instrumental in bringing about their increasingly broad application not only to machine tools but mechanical equipment generally.

Easily and quickly formed phenol resin cams extend the use of automatic screw machines to short production runs



DO ACCOUNTANTS MAKE GOOD SALESMEN

Mechanical accountants do. And manufacturers of a wide range of machines are building into their products the most complete and competent line of "mechanical accountants" available—Veeder-Root Counting and Computing Devices. Veeder-Root Counters keep the books straight on production. They keep an accurate record of every stroke of work a machine does—the stops, starts, revolutions, as well as pieces or volumes produced.

They provide production men with a ledger of figures that put costs in a better light.

Men, buying machines, look for the utility that goes with built-in Veeder-Root Counting and Computing Devices. See, now, if Veeder-Root engineers can show you how counters or computers can make your machines more salable. Write for booklet. No obligation at all.

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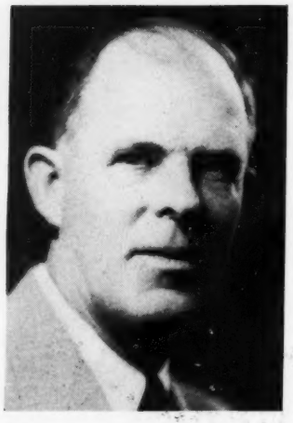
Men of Machines



CARLETON E. STRYKER

WELL-KNOWN Pacific coast aircraft engineer, Carleton E. Stryker has recently been added to the staff of Society of Automotive Engineers to take charge of the society's national defense responsibilities in establishing aircraft and aircraft-engine parts and materials standards which the society will undertake inasmuch as "it already possesses the system and machinery for carrying out the job."

Mr. Stryker before his present appointment was associated with Bendix Aviation Ltd., Burbank, Calif. He has been in the aeronautical industry since 1917 and was an instructor at U. S. Navy Aviation Gas Engine school, Columbia university during the World war. He then joined Great Lakes Aviation school. Since the war Mr. Stryker has designed powerplants for Aircraft Engine Co., was designer and engineer for Airplane Development Corp., and then became chief engineer of Curtiss-Wright Technical Institute of Aeronautics.

W. RICHISON SCHOFIELD

ONE of the pioneers in the development of methods and equipment for regulating temperature and combustion, W. Richison Schofield, formerly chief engineer of Leeds & Northrup Co., has recently been appointed director of engineering—a newly created post which encompasses not only general direction of the company's engineering activities, but also supervision of inspection and maintenance engineering.

Mr. Schofield, a native of Philadelphia, attended the school of electrical engineering, University of Pennsylvania. Following a brief connection with Philadelphia Electric Co. he joined Leeds & Northrup in 1916 and twelve years later was advanced to the post of chief engineer. An authority on pyrometry and automatic control, he holds a number of patents covering control devices. He is an active member of the A.S.M.E. Committee on Industrial Instruments and Regulators, and the A.I.E.E. Committee on Electrochemistry and Electrometallurgy.

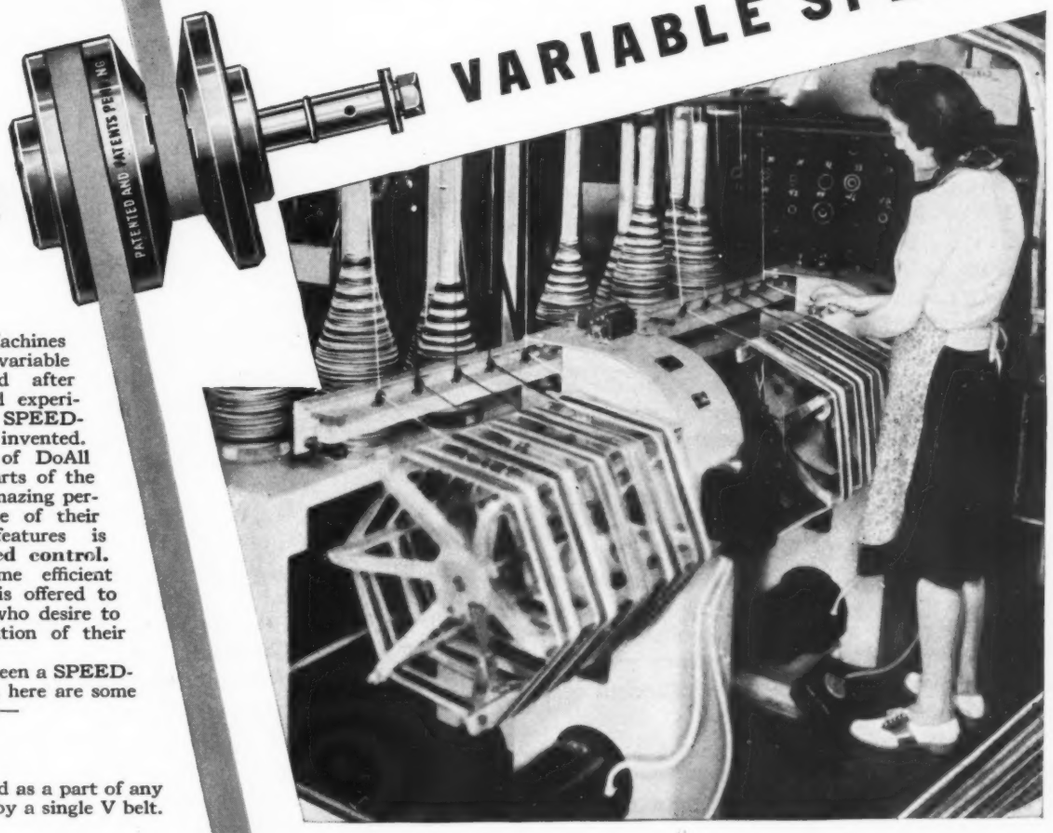
A. T. COLWELL

AT. COLWELL, vice president of Thompson Products Inc., is the presidential nominee for the Society of Automotive Engineers Inc. This appointment has come to Mr. Colwell after considerable activity on his part in the affairs of the society. He has served on the following committees: production activity, tractor and industrial power equipment activity, the sections committee, iron and steel division, parts and fittings division, the standards committee and several others.

His engineering career is also a distinguished one. Graduating from the U. S. Military Academy at West Point, he continued at the Engineer School, U. S. Army at Fort Humphreys, Va. After postgraduate work, Mr. Colwell was promoted to first lieutenant and continued in the army for two years. He then resigned to join Steel Products Co. which later became Thompson Products Inc., where after a period during which he was in charge of sales and engineering in that company's Michigan territory he

SPEEDMASTER

FOR VARIABLE SPEED



DoAll Contour Machines needed a more variable speed device, and after much research and experimenting, the SPEEDMASTER was invented. Today thousands of DoAll Machines in all parts of the world are giving amazing performances and one of their most talked-of features is their **perfect speed control.**

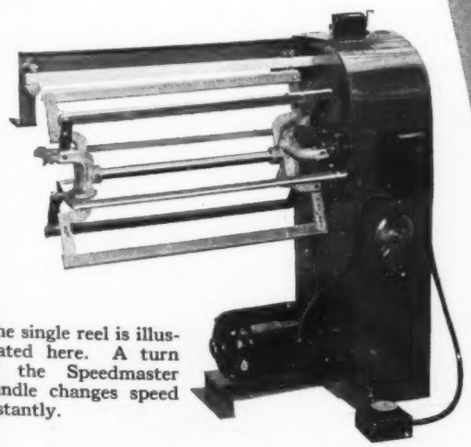
Now — this same efficient SPEEDMASTER is offered to all manufacturers who desire to improve the operation of their machines.

If you have not seen a SPEEDMASTER at work, here are some of the high spots—

- 6 to 1 ratio.
- Easily engineered as a part of any machine driven by a single V belt.
- Adjusts instantly to any speed to suit operator, kind of work being done, variations in temperature, etc.
- Speed changed at touch by anyone, while machine is running.

FIDELITY SKEIN REELING MACHINE

The Speedmaster is incorporated in both the Single and the Double Skein Reeling Machines made by Fidelity Machine Company of Philadelphia, thus adding to the efficiency of these machines, which are so popular among yarn converters today.



The single reel is illustrated here. A turn of the Speedmaster handle changes speed instantly.

IMPROVE YOUR MACHINES WITH A SPEEDMASTER

If you want your machines to operate at variable speed, with moderate power requirements, the SPEEDMASTER can help you. Mount and adjust it to suit yourself. No shifting or changing of motor. It operates noiselessly at any angle with standard "V" belts. Comes in two sizes, with maximum pitch diameters of $6\frac{1}{2}$" and $3\frac{1}{2}$".

A FEW OF THE MANY SUCCESSFUL SPEEDMASTER USERS

Fitchburg Grinding Machine Corp., Fitchburg, Mass.	Schauer Machine Co., Cincinnati, Ohio
J. W. Allen & Co., Chicago, Ill.	Merrimac Hat Corporation, Amesbury, Mass.
International Paper Box Co., Nashua, N. H.	Corning Glass Works, Corning, N. Y.
A. H. Nilson Machine Co., Bridgeport, Conn.	Union Steel Products Co., Albion, Mich.

We invite correspondence from every manufacturer who desires to improve the speed operation control of his machines, and shall be glad to send a SPEEDMASTER and inform you, out of our long experience, how this modern device can be adapted to your machines.

THE SPEEDMASTER COMPANY

Div. Continental Machines, Inc.

1202 Thacker St., Desplaines, Ill.

was appointed chief engineer. In 1934 he was advanced to the position of director of engineering and three years later was appointed vice president in charge of engineering in which post he remained until his appointment last year as director of the company. Mr. Colwell is credited with much of the successful research and development work done on improved heat-resistant valves and valve seat inserts, especially for high-duty automobile and aircraft engines.

♦

CHARLES J. MARKS has been appointed chief tool engineer of United Aircraft Corp., East Hartford, Conn. Mr. Marks has had long experience in connection with aeronautical engines having been connected with the E. W. Bliss Co. and Simplex Automobile Co. When the latter was building aircraft engines during the World War, Mr. Marks was process engineer.

♦

EARL I. BEMENT, vice president of Methods Engineering Council, has been elected president of the Pittsburgh chapter of the Society for the Advancement of Management.

♦

JOHN E. GARLENT has recently been appointed executive vice president of Motor Wheel Corp., Lansing, Mich. For the past six years he has been vice president in charge of manufacturing, which position he will retain. Identified with the automotive parts industry for many years, Mr. Garlent has been associated with Motor Wheel company since its organization in 1920.

♦

JOHN W. HARSCH formerly assistant chief engineer of Leeds & Northrup Co., has been advanced to chief engineer and JOHN F. QUEREAU succeeds Mr. Harsch as assistant chief engineer. Mr. Harsch has been with the company since 1924 and became assistant chief engineer in four years. Mr. Quereau joined the organization in 1929 and has invented a number of thermocouple and resistance thermometer devices.

♦

PAUL V. MCKINNEY has been appointed director of research for the Nevilie Co., Pittsburgh. Dr. McKinney leaves Mellon institute to engage in research for the Neville Co., on synthetic resins and organic chemicals.

♦

EUGENE JACKSON has been made metallurgical engineer of the Copper Iron and Steel Development association, with headquarters in Cleveland.

♦

WILLIAM S. KNUDSEN, president, General Motors Corp., has tendered his resignation as president in order to devote himself to his governmental duties as member of the Nationl Defense Advisory commission. Mr. Knudsen has been on leave of absence since June 1, 1940.

♦

DR. LILLIAN M. GILBRETH, president of Gilbreth Inc., and widow of Frank Bunker Gilbreth, with whom she pioneered in studying relationships between men and machines has been made an honorary life member of the Engineering Woman's Club, New York, for "scientific achievements in the field of industrial psychology and pioneer work in applying these principles to the practical problems of the efficiency of human labor."

♦

ROBERT F. HERRICK JR., director of Reed-Prentice Corp., Worcester, Mass., has been elected a vice president of the corporation.

♦

EDWARD J. CHARLTON has been appointed general manager of Lukenweld Inc., Coatesville, Pa. He has been a design engineer since 1931. GEORGE L. SNYDER, since 1937 assistant chief engineer, has been named chief engineer of the organization; and D. BRUCE JOHNSTON has been appointed manager of development and research.

♦

DR. CLAUDE L. CLARK, formerly of the department of engineering research, University of Michigan, has joined the metallurgical staff of the Steel & Tube division, Timken Roller Bearing Co. Dr. Clark will serve in the capacity of metallurgical development engineer.

♦

C. J. MILLER, president of The Fremont Foundry Co., Fremont, O., has recently been appointed president of The Gray Iron Founders' Society Inc. In 1906 when Mr. Miller with Henry Sheible of Cleveland became interested in the manufacture of the Moncrief furnace, Mr. Miller developed a sand blast table called Humane which later was manufactured by American Foundry Equipment Co. In 1920 he organized the Fremont Foundry Co., which has since been operated under his direction.

♦

H. J. FRENCH and T. N. ARMSTRONG, connected with the development and research division of The International Nickel Co. Inc., have been awarded the Lincoln Gold Medal for 1940 for the technical paper, "Weld Hardening of Carbon and Alloy Steels."

♦

E. W. ENGSTROM, formerly director of general research of RCA Mfg. Co., Inc., Camden, N. J., has recently been appointed manager of all research activities for the company.

♦

C. L. MCCUEN, vice president of General Motors Corp., was elected member of the Administration committee, and HARLEY J. EARL, director of the corporation's styling section, was elected a vice president.

♦

E. GORDON FOX, vice president of Freyn Engineering Co., Chicago, was recently elected president of the Western Society of Engineers.

♦

DAVIS D. WILSON is now a member of the engineering department of Oil Well Supply Co., Dallas, Tex.

♦

D. W. MURPHY is leaving the department of engineering research of the University of Michigan to join the staff of the development and research department of Bethlehem Steel Co. Here he will fill the position of research engineer.

Tracing Paper can be Transparentized with OIL

—but we have found a better way

A radically new transparentizing agent—developed in the K&E laboratories—produced this truly permanent tracing paper! Albanene is made of 100% long fiber pure white rags treated with *Albanite*, a new crystal clear synthetic solid. It is free from oil and wax—physically and chemically inert. Albanene will not oxidize, turn yellow, become brittle or lose transparency with age.

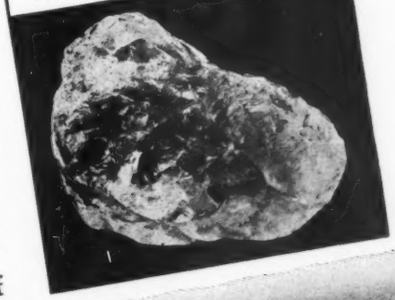
Equally important, Albanene has *all* the working qualities you've always wanted . . . a fine hard "tooth" that takes ink or pencil beautifully and erases with ease . . . a high degree of transparency that makes tracing simple and produces strong sharp blueprints . . . and extra strength to stand up under constant corrections, filing and rough handling. Because Albanene is truly permanent, *it will retain all these characteristics indefinitely!*

Most tracing papers are treated with OIL

MINERAL OIL. Most tracing papers are treated with some kind of oil. Mineral oil is physically unstable, tends to "drift," never dries completely. Papers treated with mineral oil pick up dust, lose transparency with age.

VEGETABLE OIL, chemically unstable, oxidizes easily. Papers treated with vegetable oil become rancid and brittle, turn yellow and opaque with age.

ALBANITE is a crystal-clear synthetic solid, free from oil and wax, physically and chemically inert. Because of this new stabilized transparentizing agent, Albanene is unaffected by harsh climates—will not oxidize, turn yellow, become brittle or lose transparency.



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REG. U. S. PAT. OFF.

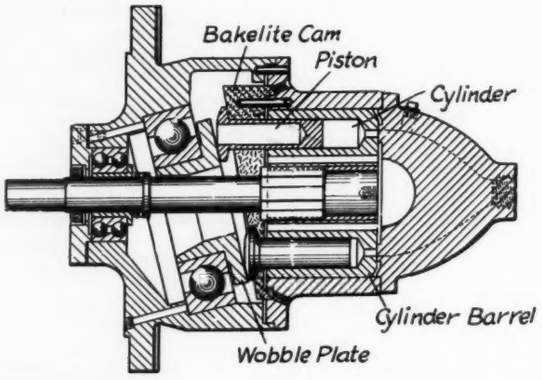
THE STABILIZED TRACING PAPER

Noteworthy PATENTS

Stationary Cam Operates Pistons

ELIMINATION of bearing and drive problems met with in conventional wobble-plate reciprocating mechanisms is achieved in this fluid pump or motor by the use of what amounts to a stationary wobble plate.

Considering the invention illustrated as a pump, the drive shaft is splined in a cylinder barrel which



Positive reciprocating drive is achieved by use of inclined bakelite cam surface

contains a number of cylinders and pistons equally spaced in a circle of which the shaft is the center. The axes of the cylinders are parallel to the shaft.

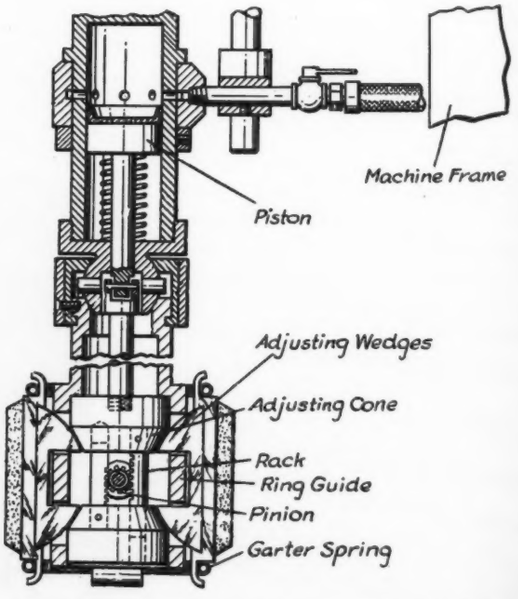
Ends of the pistons are flanged to provide line contact with the inclined wobble plate which is supported by a combination thrust and radial ball bearing. The opposite faces of the piston flanges are in line contact with a bakelite or other nonmetallic obliquely truncated hollow cylinder, the oblique face of which is parallel to the bearing face of the wobble plate. This bakelite cam serves to hold the pistons in constant contact with the plate and results in quiet, positive operation without the use of pins or links. Hydraulic fluid handled serves as a lubricant to prevent wear of both the pistons in the cylinder bores and the cylinder barrel which rotates in the pump housing.

Rotation of the cylinder barrel permits extremely simple valving to be used. Valves are merely ports cast in the pump head. Inlet and outlet ports are 180 degrees opposed and extend for approximately a quadrant of a circle, each opening progressively into the ends of the cylinders as the barrel rotates. The patent is assigned to the Waterbury Tool Co.

Hone Applies Uniform Pressure

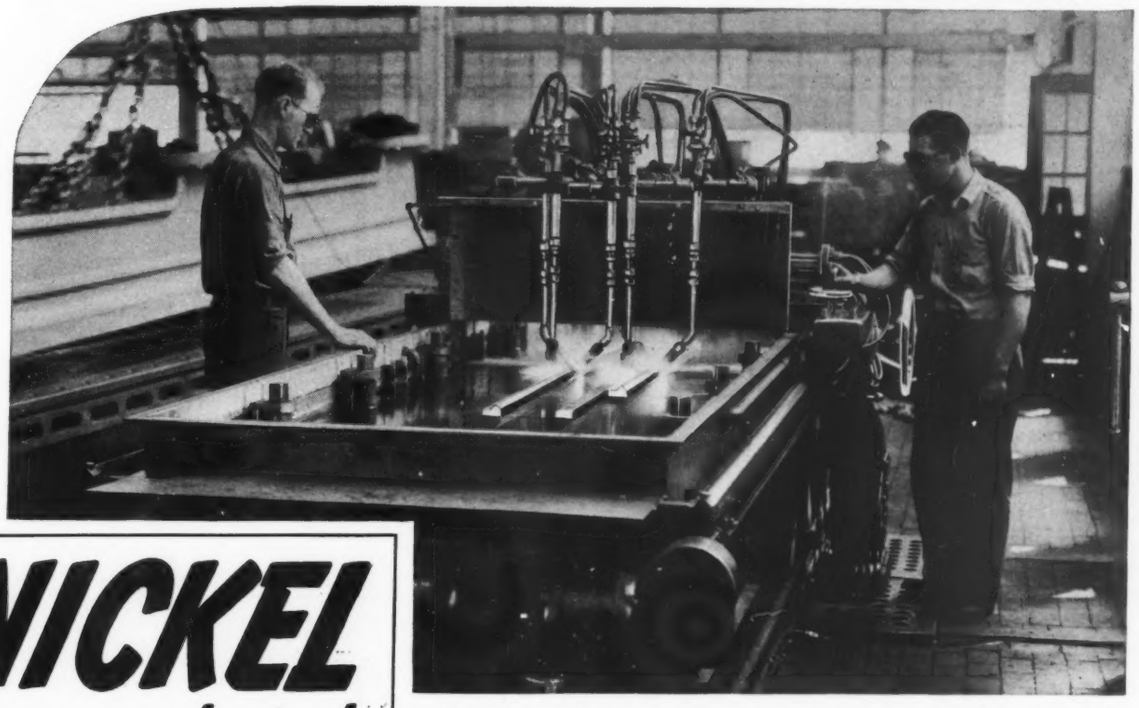
UNIFORM pressure exerted by all four abrasive sticks as well as uniform load distribution across the length of each stick is attained with this head for honing inside cylindrical surfaces.

An hydraulic piston is connected through a universal joint to the upper of two adjusting cones. To each cone is fastened a cylindrical rod which guides in a hole in the other cone. Rack teeth are cut on these rods which engage with a pinion gear mounted on a shaft held in the guide ring. The piston, in moving down, moves down the upper adjusting cone. The attached rack, through the pinion, thus moves the lower cone up. The two co-acting cones move the adjusting wedges radially to apply pressure on the cylinder wall



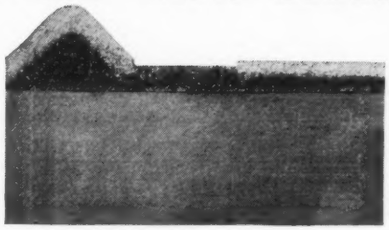
Reciprocating and rotating motion of the hones is achieved without disturbing uniform application of pressure

UNIFORMLY SUCCESSFUL FOR FLAME HARDENING



NICKEL additions to cast iron tend to condition the metal for flame hardening operations. Here the Monarch Machine Tool Co., Sidney, Ohio, is flame hardening ways used on Monarch lathes. Travelling at 3" to 6" per minute, oxy-acetylene jets pass only once to raise the surface Brinell hardness of this Nickel cast iron from 225/240 to 450/460. Average composition is Total Carbon 3.00, Silicon 1.70, Manganese 0.85, Nickel 1.50, Chromium 0.30%. Monarch states "The use of a carefully controlled nickel alloy cast iron can be depended on to eliminate hard spots and also to stabilize that portion of the carbide in the pearlitic matrix necessary for flame hardening to the fullest degree."

NICKEL irons and steels



A BROKEN cross-section of a Monarch Nickel cast iron lathe bed shows ⅛" penetration after flame hardening. Nickel tends to "blend" this hardened surface into the core.

NICKEL alloy steels are especially well adaptable for flame hardening. Photo shows Wesley Steel Treating Co., Milwaukee, simultaneously flame hardening both faces of teeth on a large gear. Cam segments of SAE 3150 Nickel-chromium steel are flame hardened by Wesley to 580 Brinell. For detailed information about Nickel alloyed materials particularly suited for modern heat treating methods, please write to the address below.

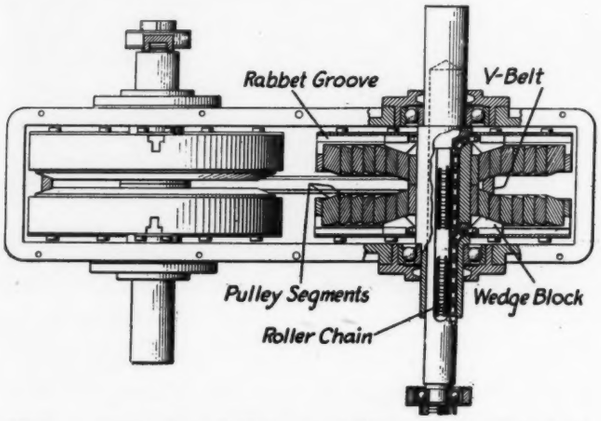
THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

and garter springs are instrumental in holding adjusting wedges against the cones. The patent is assigned to the Norton Co.

Wedges Adjust Pitch Diameter

WIDE range of speed adjustment with shafts mounted on fixed centers is possible with the variable speed pulley assembly illustrated. The adjustable sections of the pulley are concentric, annular rings, the cross sections of which are parallelograms.

Outer retaining plates of the pulley sections contain four rabbetted slots which serve as guides for the adjusting wedges. These wedge blocks are fastened to roller chains which are constrained in the rabbet grooves and in slots in an actuating shaft contained within the hollow main pulley shaft. Hence, being completely guided, the chain can be used as either a thrust



Wide range of infinitely variable speed control is claimed for this compact machine drive

or tension member to adjust the wedge blocks.

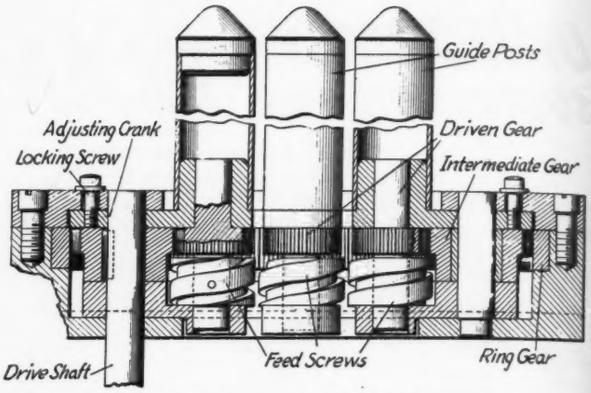
A cam and lever mechanism, not shown in the illustration, is used to provide simultaneous adjustments to both pulleys thus maintaining a controlled belt tension. The patent is assigned to Manning, Maxwell and Moore Inc.

Disks Fed Singly by Screws

DESIGNED to feed can ends or similar disks singly from the bottom of a stack, the mechanism illustrated in section is adjustable to accommodate a range of different disk diameters.

Four guide posts equally spaced about the circumference of a circle constitute the disk magazine chamber. Each of the guide posts is bushed in one end of an adjusting crank, the other end carrying a bearing in which runs one of the four intermediate gear shafts. Each intermediate gear is in mesh with the internal ring gear mounted to rotate in the housing and also with one of the driven gears mounted concentrically with the guide posts. Each of the driven gears carries a feed screw the thread of which extends beyond the addendum of the driven gear.

The stack of disks or can ends rests on the top of



Square cut screw threads constitute the feeding mechanism in this magazine chamber for can ends

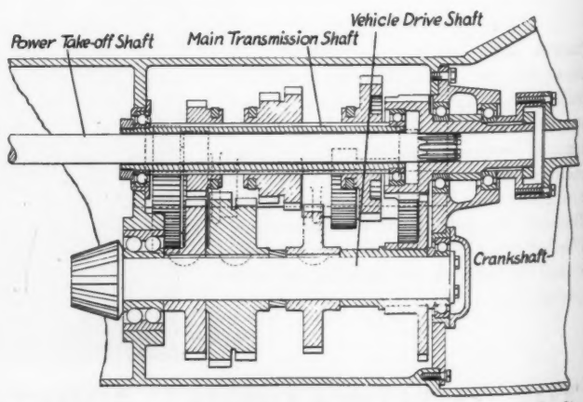
these screw threads. As the drive shaft is rotated, the ring gear transmits rotation to each of the feed screws through the intermediate gears in such a manner that the end of the screw threads pick one disk from the bottom of the stack and lower it down through the feeder. One disk is so fed for each revolution of the feed screws.

Adjustment for different disk diameters is accomplished by loosening the locking screws which permits the adjusting cranks (which carry the guide posts) to be rotated about the intermediate gear shafts to accommodate any diameter within the limits of the mechanism. The patent is assigned to the Continental Can Co.

Full Floating Take-Off Shaft

POWER take-off shaft in a newly designed drive is direct connected to the prime mover and operates independently of the main drive transmission. Further, the shaft may be removed without in any way disturbing the operation of the transmission.

These design features are achieved by means of a tubular main transmission shaft on which conventional gearing is splined. The power take-off shaft operates within the transmission shaft, being splined at its right end to the hollow crankshaft extension. The patent is assigned to International Harvester Co.



Take-off shaft concentric with transmission shaft provides operation independent of transmission

PIONEERS of QUALITY
BOWER
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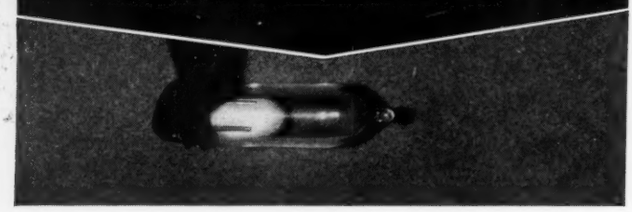
Detroit, Michigan

HERE'S A MACHINE THAT PERFORMS 8,000,000 OPERATIONS

...QUIETLY...QUICKLY...DEPENDABLY



YET THIS NEW SMALL G-E MERCURY KON-NEC-TOR LISTS AT ONLY 20c

GENERAL ELECTRIC'S new small size mercury Kon-nec-tor, an all-glass mercury switch with 5 amperes continuous current capacity, is well adapted to the design of many kinds of electrical machinery, particularly advertising displays. It will operate millions of times quietly, quickly, and dependably . . . with unvarying efficiency. Yet it lists at only 20c complete with lead wires and at only 15c without lead wires! The lead wires are specially designed for maximum flexibility and proper carrying capacities.

In addition to advertising displays, this new G-E Kon-nec-tor may be used as an automatic door switch on mechanical refrigerators, and on the glove and luggage compartments on automobiles. Like other types of G-E Kon-nec-tors, this new small size mercury switch is a safe, dependable, long-lived contact device. For further information, write or wire the address given below.

HERE ARE OTHER TYPES OF G-E KON-NEC-TORS

These simple, modern mercury switches are corrosion-proof, flash-proof, and dust-proof. Adaptable to the design of all kinds of electrical machinery, they provide positive make-and-break of the electric circuits involved.

NELA SPECIALTY DIVISION, LAMP DEPT.

GENERAL ELECTRIC

410 Eighth Street, Hoboken, N. J.

ASSETS to a BOOKCASE

Vibration of Rail and Road Vehicles

By B. S. Cain; published by the Pitman Publishing Corp., 2 West Forty-fifth street, New York; 258 pages, 5⅝ inches by 8¾ inches, cloth bound; available through MACHINE DESIGN *for* $5 *postpaid.*

Subject matter of this book is not as specialized as its title would indicate, the first half of the volume discussing the theory of vibration and hence being of interest to all designers. The section dealing specifically with automobiles also has a great deal of general information, such as that relating to engine mountings, static and dynamic measurements, and spring suspension and weight distribution.

For designers working directly with automobiles, street cars, railway vehicles and similar machines, the book will be extremely helpful. A great amount of research is correlated.

Inasmuch as the book was written to help engineers and vibration specialists understand their respective problems, simple general principles are given whenever possible, although more complicated subjects are also included.

□ □ □

Graphical Treatment of Vibration

By C. H. Powell; published by Bookcraft, New York; 288 pages, 6 by 9 inches, cloth bound; available through MACHINE DESIGN *for* $7.50 *postpaid.*

Use of the graphical method as a counterpart and supplement of the analytical method for treatment of vibration problems is urged strongly in this volume. Lagrange's equations, involving no figures or diagrams, are used freely in the development of the pendulum damper, and the correspondence of the action of this damper with that of the frictionless dynamic damper is harmonized by use of the graphical concept.

The author points out in addition that "in the action of those dampers, the principle of which is to counterbalance an undesirable force with a force specifically added, the question of phase is of paramount importance. It is here that the graphical representation reveals its intrinsic worth."

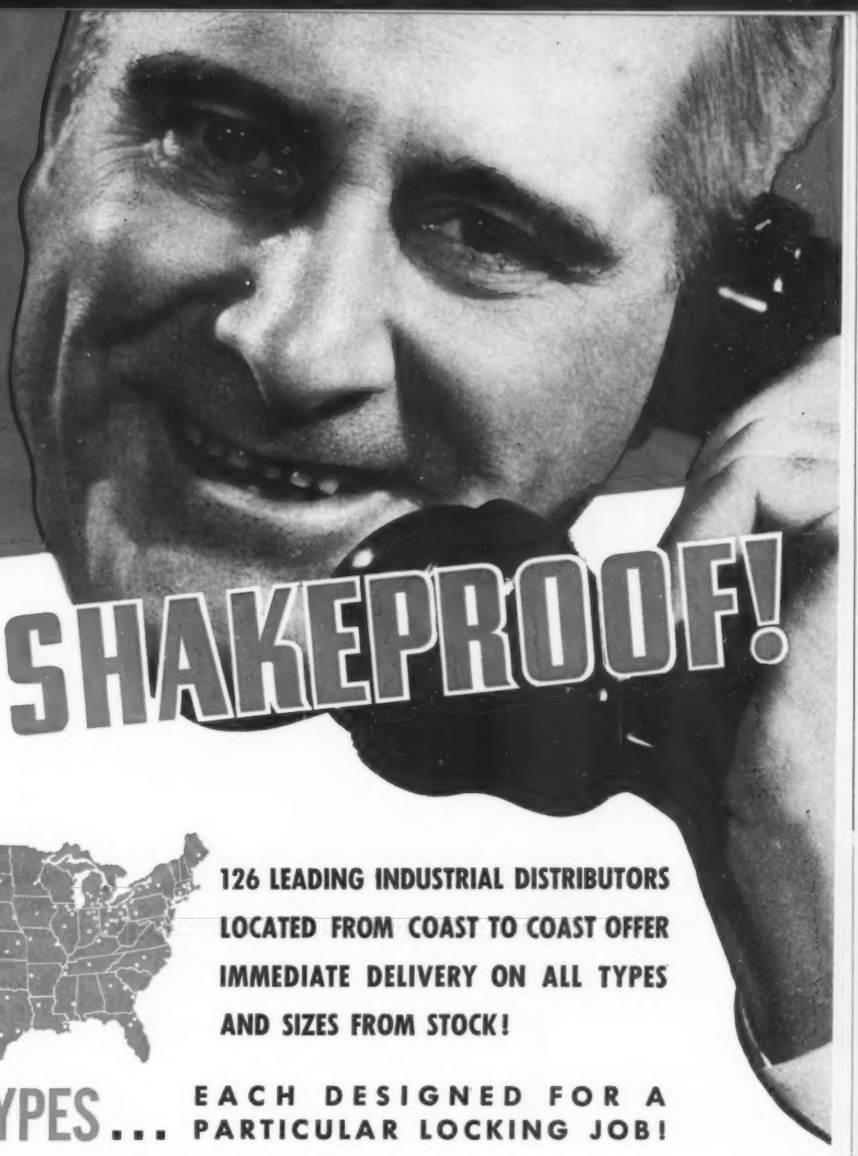
Fundamental principles on which a damper works are deemed sufficient to cover the subject, and detailed drawings of dampers are omitted because of the author's opinion there is no standard damper.

□ □ □

Kinematics of Machines

By George L. Guillet; published by John Wiley & Sons Inc., New York; 300 pages, 5½ by 8½ inches, cloth bound; available through MACHINE DESIGN *for* $3 *postpaid.*

Fourth edition of this textbook has been slightly



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EXTERNAL—for U. S. Standard nuts and large head machine screws, such as binder, oven and washer head types.

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126 LEADING INDUSTRIAL DISTRIBUTORS LOCATED FROM COAST TO COAST OFFER IMMEDIATE DELIVERY ON ALL TYPES AND SIZES FROM STOCK!

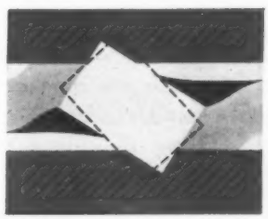
FOUR TYPES... EACH DESIGNED FOR A PARTICULAR LOCKING JOB!

A leading Industrial Distributor located near you is ready to deliver from stock the exact sizes and types of Shakeproof Lock Washers that you need to give your product thorough protection against vibration. The powerful locking action of the exclusive tapered-twisted tooth design plus the fact that there are four separate types—each one engineered to lock a particular kind of screw or nut fastening—assures greater locking efficiency. Don't merely ask for lock washers—specify Shakeproof!

FREE SAMPLE RING!

Ask your distributor's salesman for a free test ring of Shakeproof Lock Washers. Test their locking power in your own shop—you'll quickly realize how they can help improve the performance of your product!

If you don't know who handles Shakeproof in your city, write us and we will send you the name of our nearest distributor immediately!



Actually Locks Tighter Under Vibration!

When vibration attacks a nut or screw locked with Shakeproof, the tapered-twisted teeth dig deeply into both surfaces, setting up a powerful lock. As vibration increases, the teeth dig deeper—never allowing any loosening action even to start!

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Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS

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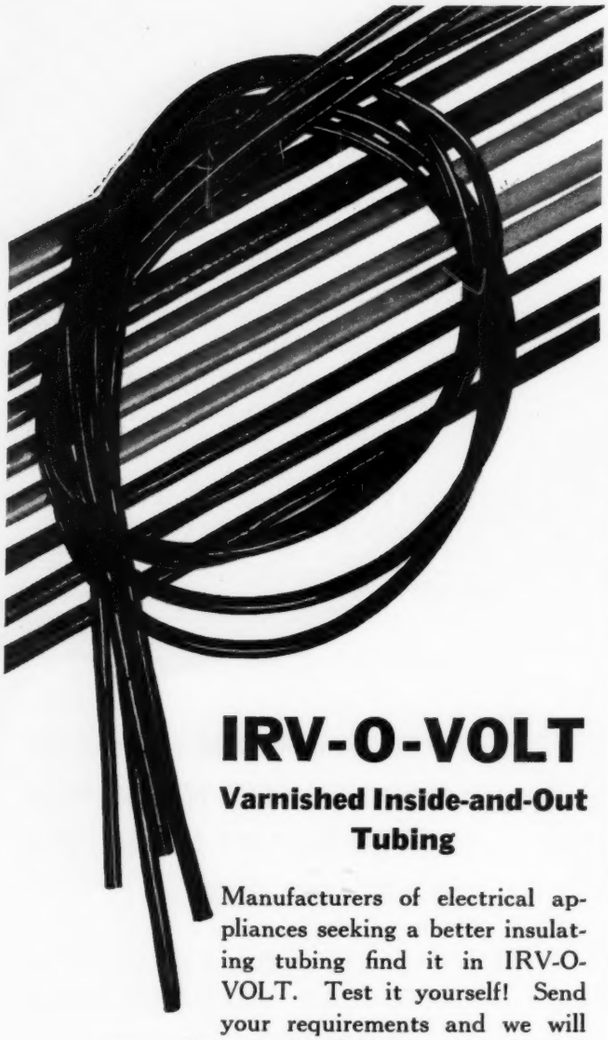
Thread-Cutting Screws . . . Locking Screws . . . Spring Washers . . . Special Stampings



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Manufacturers of electrical appliances seeking a better insulating tubing find it in IRV-O-VOLT. Test it yourself! Send your requirements and we will promptly forward suitable samples, plus full data and prices on all IRV-O-VOLT tubing. Here's what you will find: better moisture resistance—longer life—smoother inside surface for quicker wire assembly—increased endurance to every bending, pulling, twisting requirement—will not soften, blister, or flow—slow-burning—fully suited to use with hot potting compounds for sealing—meets all latest A.S.T.M. requirements for oleoresinous varnished products. IRV-O-VOLT can improve your product, lower its cost of manufacture. Consider its use when designing new products or when improving present products.

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expanded and various sections have been rewritten for clarity. The number of problems has been increased and the chapter on gears has been revised to conform to present standards.

□ □ □

Machine Design

By Louis J. Bradford and Paul B. Eaton; published by John Wiley & Sons Inc., New York; 275 pages, 6 by 9 inches, cloth bound; available through MACHINE DESIGN *for* $3 *postpaid.*

This relatively simple textbook is now in its fourth edition and makes no pretense to being extensive. Material included is intended only to ground the student in fundamental facts, processes, and analyses of machine design. Discussions of special types of machines are omitted and only enough extended data has been included to impart to students a sense of values. Function of the book is to teach use of data, rather than to be a source of information. Unfortunately this fact limits its scope.

In order to emphasize fundamental principles, short-cut formulas have been avoided and graphical methods are employed only rarely. The authors believe that if the student understandas the fundamental equations involved in the solution of a given problem, he will be able to develop his own short-cut formulas. Examples have been used freely to clarify the general statements of methods employed in attacking various problems.

It is notable, however, that the fourth edition reflects the changes in machine design in the last several years. These changes include advances in the practice of gear design, improved methods of spring design and the increasing use of V-belts for power transmission. The authors have also found it necessary to expand the sections dealing with the selection of ball and roller bearings.

□ □ □

Theory and Design of Springs

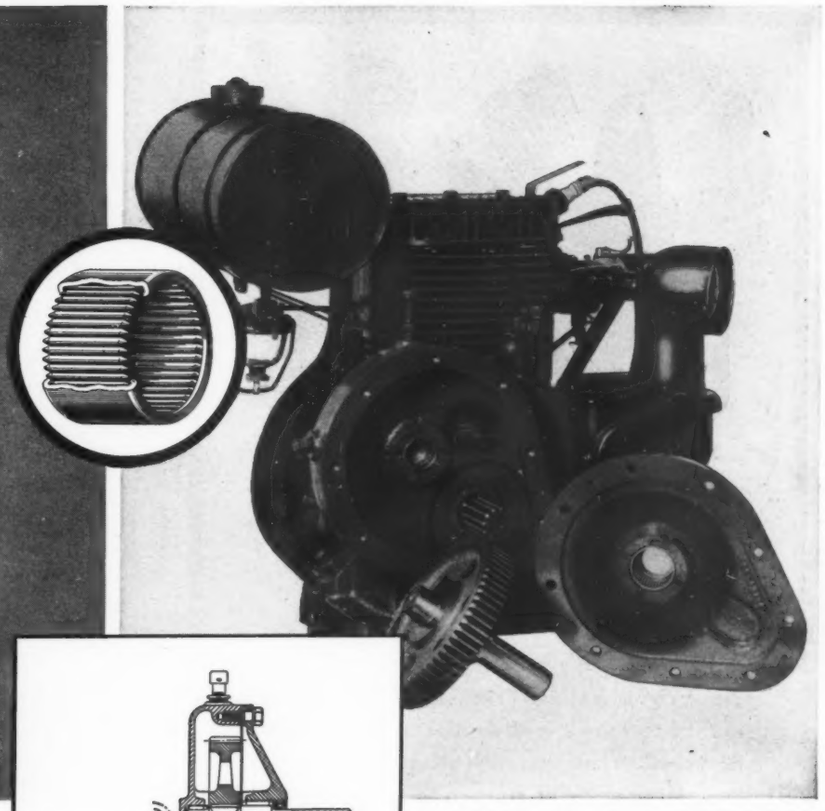
By Fred M. Cousins; published by Edwards Bros. Inc., Ann Arbor, Mich.; 99 pages, 8 by 11 inches, cloth bound; available through MACHINE DESIGN *for* $2.50 *postpaid.*

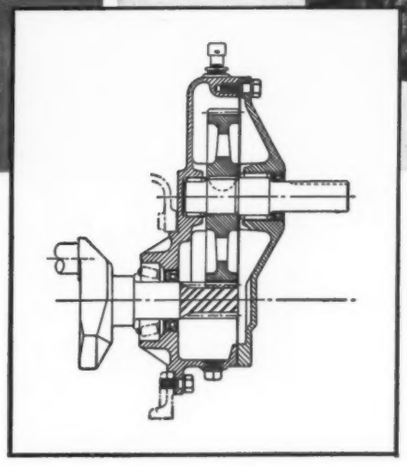
Analysis of the more general types of springs is given in this volume, an especially handy one because of its large page size. No effort is made to present original work. The author merely sums up the best available information on the design of springs, and in so doing is able to give more readily usable data than would be possible if he were discussing his own experiments. At the same time the information is broader in scope than that customarily given in books on machine design in general.

The author points out that the design of springs can hardly be any longer considered a matter of trial and error. Instead, best use of mathematical and experimental analysis must be made.

An excellent bibliography on spring design is appended.

WISCONSIN PICKS TORRINGTON NEEDLE BEARING FOR SMALL SIZE & HIGH CAPACITY





(*Above*) Disassembled gear reduction housing on the Model AB WISCONSIN air-cooled industrial engine illustrates how two Needle Bearings contribute to long, trouble-free anti-friction performance.

(*Left*) Cross-section shows how readily the Torrington Needle Bearing adapts itself to compact design.

GETS COST REDUCTION AND SERVICE RECORD AS WELL

For the reduction gear assembly of its famous air-cooled Model AB gasoline engine, the Wisconsin Motor Company selected the Torrington Needle Bearing for *small size* and *high capacity*. And, in addition, they secured two other important advantages—*reduction in machining and assembly costs*, and a *service record of no bearing failure in 1,800 installations*.

"We adopted the Torrington Needle Bearing," says A. H. Wehmeyer, Assistant Chief Engineer, "because in our gear reduction unit, the center between the main take-off shaft and the engine crankshaft was so close that it meant the use of a bearing with minimum radial thickness and at the same time a high load capacity.

"And," adds Mr. Wehmeyer, "since the Needle Bearing has these qualities, and required a minimum diametrical bore for installation, we cut down the machining and assembly cost. As far as service is concerned, we have shipped out 1,800 reduction unit installations on the engine, and, to date, *have not received one complaint due to bearing failure.*"

Performance like this is typical of the Torrington Needle Bearing—for it is engineered for long life under severe conditions. And its ready adaptability to product design is another characteristic. Because of its simple construction, small diameter and long axis, its ease of assembly and lubrication; it introduces no design complications. In fact, it frequently offers opportunities for simplification in the design of surrounding members, with consequent savings in space, weight and cost.

The Torrington Engineering Department will gladly work with you in adapting the advantages of the Needle Bearing to *your* product. For further information write for Catalog No. 9. For Needle Bearings to be used in heavier service, request Booklet 103X from our associate, the Bantam Bearings Corporation, South Bend, Ind.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

Makers of Needle and Ball Bearings

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NEEDLE BEARING

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Proof of the quality of Matsurf and Arkwright Pencil Tracing Cloths is their ability to take ink drawings as well as they do pencil. These pencil tracing cloths have a "tooth" that takes a sharp, clear pencil line, and a smooth, clean ink line that won't feather, crack or chip off.

To give necessary protection to your important drawings, insist on Matsurf, the cloth with one dull side and glazed back, or Arkwright Pencil Tracing Cloths with satin finish on both sides. You'll be assured of permanent transparency – and you'll not have to worry about pinholes or brittleness ruining your work. Next time you order pencil tracing cloth, try Matsurf or Arkwright!

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New PARTS AND MATERIALS

Gasoline Engine Is Air-Cooled

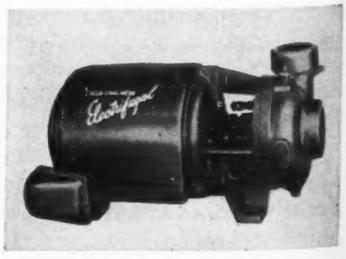
A FOUR-CYLINDER, four-cycle air-cooled engine, Model VE-4, is announced by the Wisconsin Motor Corp., Milwaukee. Positive cooling is obtained from a large fan cast in the flywheel which forces a strong blast of air across and around the cylinders and heads. Oiling system is entirely self-contained. A heavy dynamically balanced crankshaft with unusually long connecting rods and lightweight pistons insures a smooth

Heavy dynamically balanced crankshaft with unusually long connecting rods insures smooth running of engine

running engine at all speeds. Close regulation at any desired speed is provided by a mechanical flyball type governor. To provide service economies in case of scoring, cylinder blocks are cast separate from the crankcase. Renewable valve seat inserts are used on both the intake and exhaust.

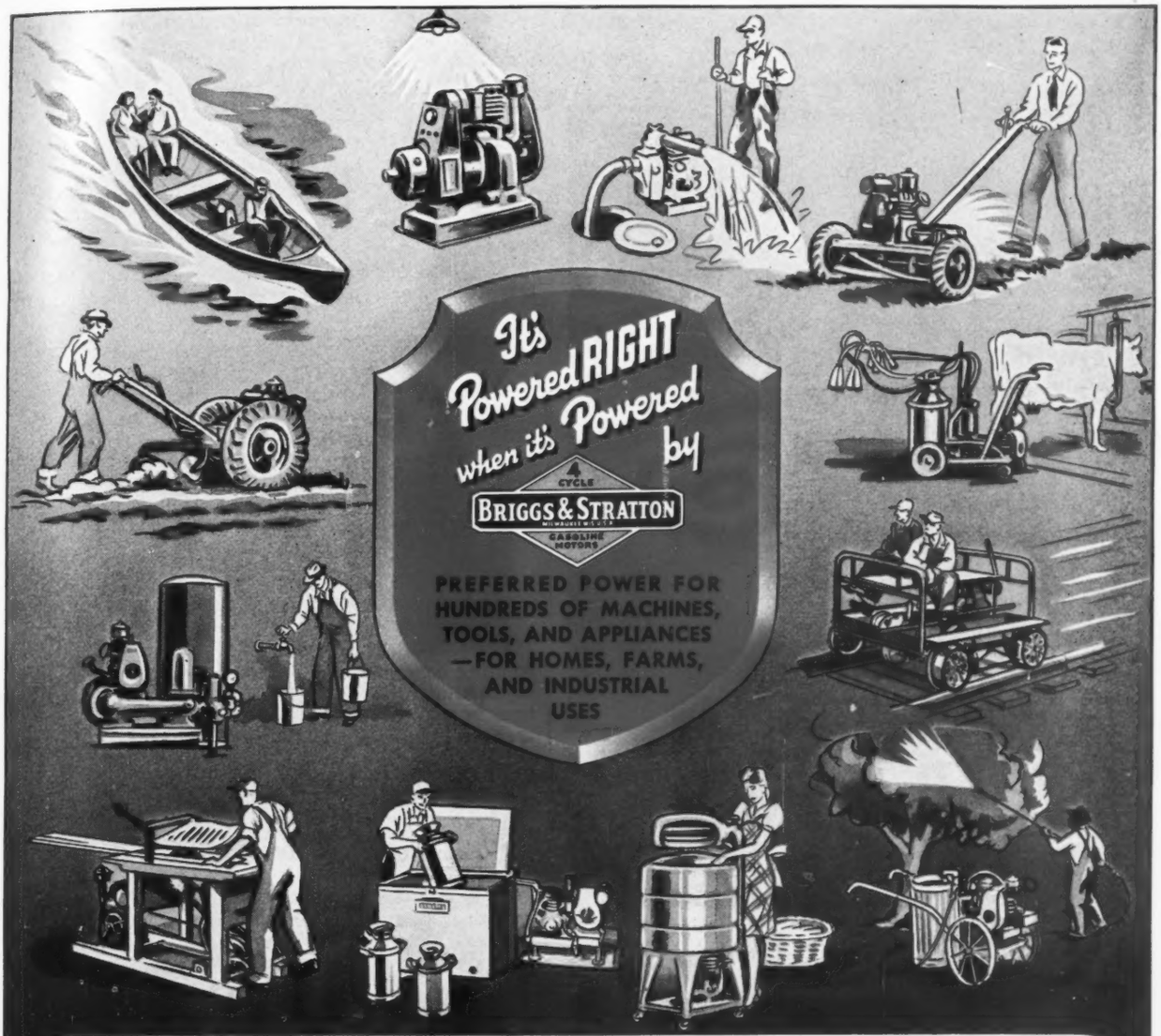
Pump and Motor Combined

DESIGNED as a complete centrifugal pump and motor unit on one shaft and one housing, an "Electrifugal" pump is announced by Allis-Chalmers Mfg. Co., Milwaukee. It has a special motor with a one-piece cast iron motor yoke and pump bracket. The motor design, with copper-bearing steel cover, meets specifications for splash proof motors. Totally enclosed, fan-cooled and explosion-proof motors are also available



Special motor with one-piece cast iron yoke and pump bracket is built into pump-motor unit

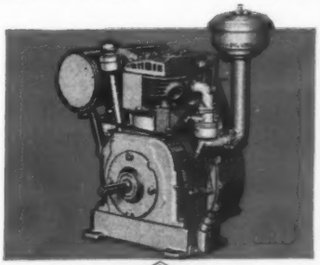
in the Electrifugal type. In splash-proof construction the pump is available in sizes from 1 to 10-horsepower inclusive at 3500 revolutions per minute and from ¾


It's Powered RIGHT when it's Powered by
4 CYCLE
BRIGGS & STRATTON
GASOLINE MOTORS
PREFERRED POWER FOR HUNDREDS OF MACHINES, TOOLS, AND APPLIANCES —FOR HOMES, FARMS, AND INDUSTRIAL USES

BRIGGS & STRATTON GASOLINE MOTORS AVAILABLE IN A WIDE RANGE OF TYPES AND POWER OUTPUT

MODERN machines and equipment demand power equally as modern. Be sure of such power — choose Briggs & Stratton air-cooled gasoline motors — soundly designed, ruggedly built, and capable of the kind of performance that builds the reputation of manufacturer and dealer.

Their dependability, economy, easy starting and trouble-free operation under all conditions of service have made them famous as *preferred power*—Briggs & Stratton motors are specified by more manufacturers—are found on a greater variety of equipment—than any other make. There is tangible extra value in machines, tools and appliances equipped with power that's preferred for all home, farm and industrial applications.



Look to Briggs & Stratton—the best known name in small gasoline motors for every field—every purpose.

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4 CYCLE
BRIGGS & STRATTON
GASOLINE MOTORS

16 in. x 7 ft.
honed cylinder

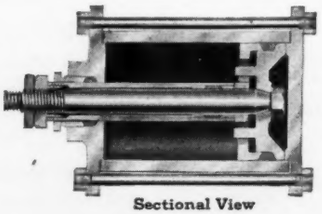
3 FEATURES for *Better* Cylinder Performance

1. Hannifin Pneumatic Cylinders (including even largest sizes) are bored and then honed, producing a straight, round, perfectly smooth cylinder interior—a better finish that means better cylinder performance.

2. Simple outside adjustment of the piston packing allows easy maintenance of high efficiency piston seal. Soft, graphite-treated piston packing, easily kept in correct adjustment, prevents leakage and means minimum friction loss.

3. Repacking of piston in an emergency can be done with ordinary graphited packing, always available. No special parts required.

Hannifin pneumatic cylinders are built in a full range of standard mountings, 1 to 16 in. diameter, for any length stroke. Both single and double acting types, with or without air cushion. Write for Bulletin 34-MD for complete specifications.



Sectional View

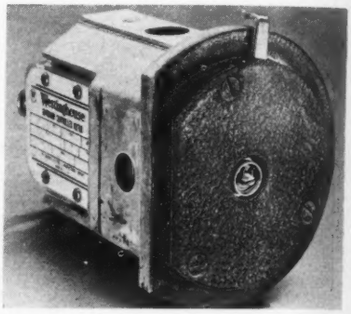
HANNIFIN MANUFACTURING COMPANY
621-631 S. Kolmar Avenue • Chicago, Illinois

HANNIFIN
PNEUMATIC CYLINDERS

to 7½-horsepower inclusive at 1750 revolutions for heads up to 160 feet. For normal service the pump is built with cast iron casing, bronze fitted. But it can be made in other metals to suit any industry.

Motors Equipped with Governors

UNIVERSAL governor-controlled motors, available in sizes from 1/50 to 1/20-horsepower, are announced by Westinghouse Electric & Mfg. Co., East Pittsburgh. These motors are suitable for a wide range of applications, including adding machines, calculating machines, check endorsers, etc. They are equipped with



Die cast housings of aluminum alloys make governor-controlled motors extremely light

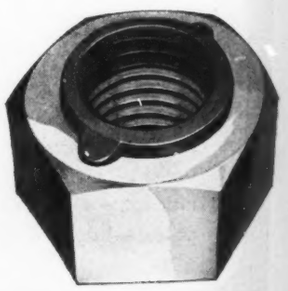
rotating contact or hinge type governors, or may have supporting arms for special type governors. Die-cast housings of aluminum alloy make these motors extremely light.

Steel Welded without Quench

MANGANAL, an austenitic, tough, nonmagnetic steel containing 11 to 13½ per cent manganese and 3½ per cent nickel is now carried in stock by Joseph T. Ryerson & Son Inc., Chicago. This abrasion resisting, nonmagnetic steel can be welded. The 3½ per cent nickel content permits Manganal plates to be welded without subsequent quenching treatment as there is no loss in toughness when it is cooled from the welding temperature. Welding rod of 18-8 stainless composition has been found to give satisfactory results when used with Manganal. This steel can be flame cut and requires no subsequent heat treatment when formed or punched hot.

Retainer in Nut Grips Bolt

A LOCKING nut that can be tightened or backed off part way, years after its application, and still retain its grip on the bolt, is announced by Security Metal Products Inc., 360 East Kalamazoo avenue, Kalamazoo, Mich. It can be taken off and reapplied many



Bolt gripping element of nut consists of slightly elliptical shaped spring steel retainer

times without losing its gripping power. The bolt gripping element of the Security nut consists of a slightly

Good Conveyor and Drive Design is Easy with LINK-BELT Silverlink ROLLER CHAIN

One of a number of Link-Belt TWIST-Type Silverlink Roller Chain drives in a western mill. The unique construction of this chain provides freedom for axial twist, yet maintains complete bearing for the pin in the direction in which it is required to carry its normal load. This feature compensates for changes in alignment of the drive.

• Design and plant engineers alike recognize the value of Silverlink's accurately finished, all-steel construction, built to the highest standards of precision . . . that it combines great strength with comparatively light weight . . . that it is extremely flexible, assures smooth operation, and is especially capable of withstanding severe shocks . . . that it minimizes wear and repair. They recognize, too, the value of Link-Belt engineering service in working out problems in connection with the use of roller chains for conveying and power transmitting.

Complete drives—chains and sprockets—from ¼ to 225 H.P., in speed ratios 1:1 up to 8:1 are stocked by distributors throughout the country. Send for free 174-page Engineering Data Book No. 1757.

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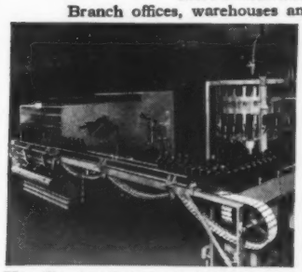
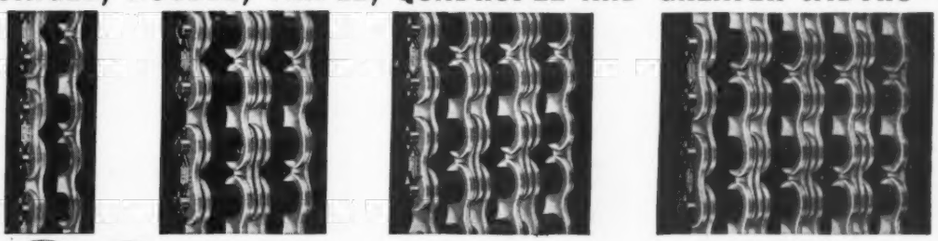
The Leading Manufacturer of Positive Power Transmitting Equipment
INDIANAPOLIS CHICAGO PHILADELPHIA ATLANTA DALLAS
SAN FRANCISCO TORONTO
Branch offices, warehouses and distributors in principal cities 2273B

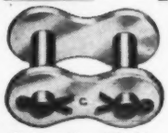


Handling bottles is typical of the many ways in which Silverlink roller chains with various attachments, speed the handling of small units, cans, jars, glassware, boxes, etc.

Oil well drilling rigs such as this get rough usage and must stand up under tough operating conditions. Silverlink roller chain is an old time oil field favorite—its use on this drilling rig being typical.

SINGLE, DOUBLE, TRIPLE, QUADRUPLE AND GREATER WIDTHS—

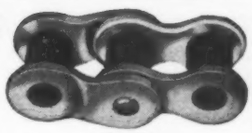




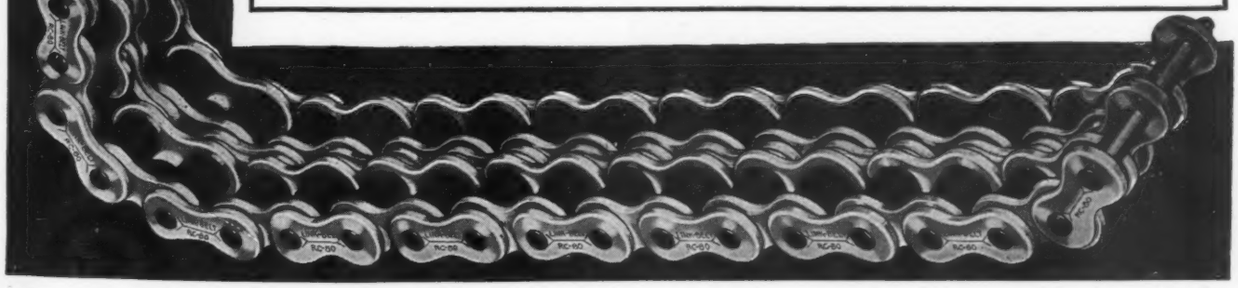
Connecting (Tight-Fit) Link and Coupler (Slip-Fit) Link.

CONNECTING AND COUPLER LINKS

Connecting and coupler links, 1 and 2-pitch offset links, and roller links can be furnished to fit all types of single, and multiple width roller chains. Available in detachable cotter pin, spring clip, or riveted type, depending upon the size of chain and service requirements.



2-Pitch Offset Link



last call!

GET YOUR
FREE
SAMPLES
BRISTO SOCKET SCREWS
NOW!

Before you forget it, mail in the coupon below. It will bring you a handy assortment of Bristo Socket Screws,—the same kind of screws specified in so many manufacturing plants for superior holding power under every operating condition. Try them at our expense, on your own work, in your own way . . . that's all we ask.

***SET* TIGHTER . . . *STAY* TIGHTER**

Thanks to the fluted socket head into which the wrench slips easily and locks snugly, you will find that a Bristo can be set up *tight*—and will hold, no matter what the service. Non-splitting, non-shearing, a Bristo Screw has more than enough strength for a *safe* set,—a set you can always depend on!

ACT NOW ON THIS OFFER

Give Bristos your *toughest* test. The free trial offer coupon brings these screws to you by return mail, along with a copy of informative Bulletin 83-8N. The Bristol Company, Mill Supply Division, Waterbury, Conn.

QUICK BRISTO FACTS

Lock-tight socket head,—won't split, shear, round out, jam or strip. Set tighter with less effort. No loosening under vibration. Take wrench without fumbling or skidding. **Designed by engineers for engineers.**

BRISTO
SOCKET SCREWS

THE BRISTOL COMPANY, Mill Supply Division
WATERBURY, CONN.
Send me sample Bristo Socket Screws in the following sizes_____
Also send me Bulletin 83-8N. (State Sizes)

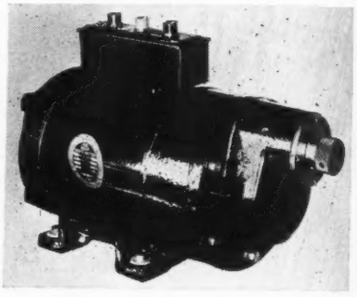
Name_____

Address_____

elliptical shaped springsteel retainer permanently seated in the head of a standard nut. When the nut is applied, the retainer is distorted from an elliptical into a circular shape, setting up a spring pressure between bolt threads and retainer threads.

Gearmotors Utilize Double Winding

SHOCKPROOF gearmotors made by the Walker-Turner Co. Inc., South avenue at Berchman street, Plainfield, N. J., are now available with a double winding which provides two speeds, instantly changeable by a pushbutton switch. This two-speed motor is available



Two speeds are provided in shockproof gearmotors

in speeds from 700 to 8000 revolutions per minute and in sizes from ¼ to 3-horsepower for polyphase circuits only. During the time this motor has been on the market in a single-speed type, not one case of gear breakage caused by shock is said to have been reported.

V-Belt Prevents Static

ACCUMULATION of static is prevented and static-discharging qualities retained during its entire life by a new V-belt announced by B. F. Goodrich Co., Akron, O. This development is of particular value in the design of machinery where static discharges might create a fire hazard. At the same time, this belt does not act as a "short" between the motor and its operator. The resistance built into the belt is just enough so that the belt itself cannot act as a direct passage for current.

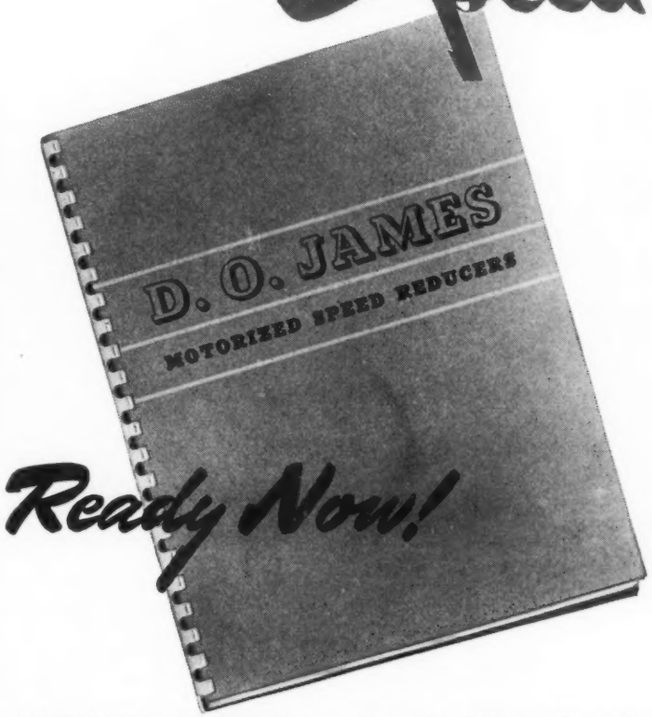
Timers Use Synchronous Motors

POWERED by slow-speed, self-starting synchronous motors, a series of 128 models of interval timers and time delay relays is announced by Paragon Electric

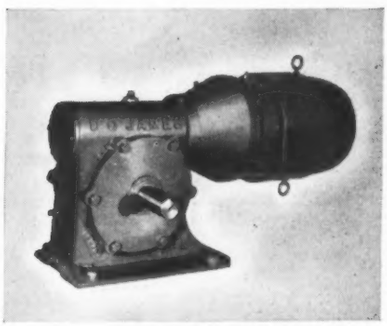
Manual or automatic reset models are available in series of timers

Co., 37 West Van Buren street, Chicago. They have fast-acting silver contact micro-switches. These all-elec-

MOTORIZED Speed Reducers



D. O. James Motorized Reducers are precision manufactured to meet the requirements of service for which they are designed. They have the highest possible efficiency, accessability and are most compact.



Motorized Worm Gear Reducer

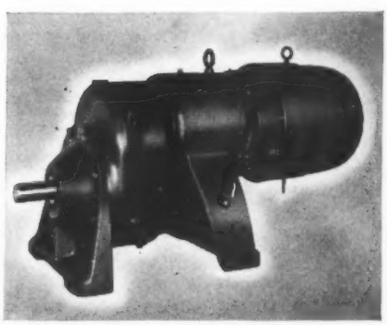
THIS CATALOG CONTAINS

112 pages of engineering data, weights and prices of the D.O.James line of Motorized Reducers. It lists completely, selection tables, service factors and character of load. Information therein will prove helpful to your engineering department in the selection of the proper type of Motorized Reducer.

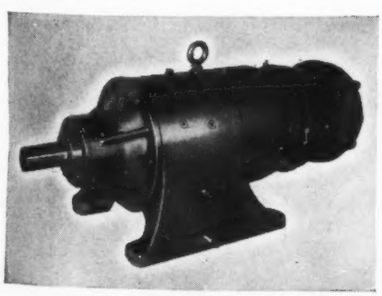
Motorized Worm Gear Reducer
With either horizontal or vertical drives. Made in 11 sizes, ratios 6 to 65:1 and a horse power range of ⅛ to 50 H. P.

Motorized Helical Reducer
With either horizontal or vertical drive. 13 sizes, ratios 1.2 to 9:1. ¾ to 50 H. P.

Motorized Planetary Reducer
Horizontal and vertical drive, made in 35 sizes, ratios 10 to 1200:1, ¾ to 75 H. P.



Motorized Helical Reducer



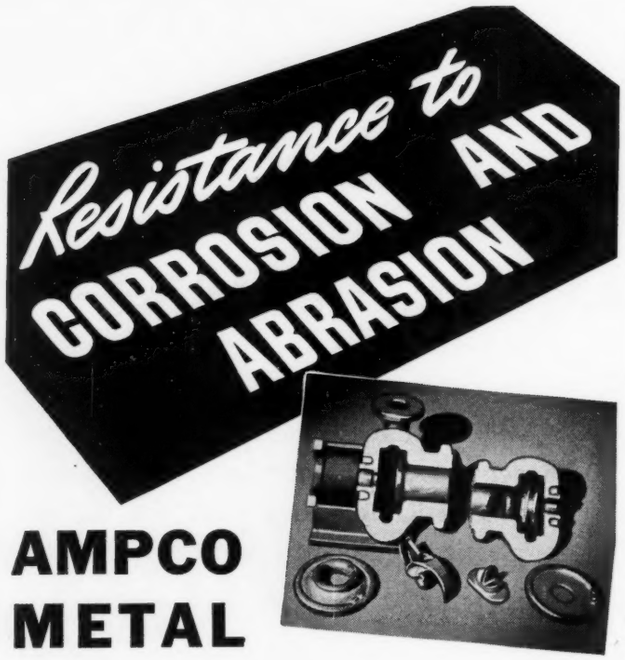
Motorized Planetary Reducer

*Send it to us!*_____

D.O.JAMES

1132 WEST MONROE STREET • CHICAGO, ILLINOIS

FOR OVER 50 YEARS MAKING ALL TYPES OF GEARS AND GEAR REDUCERS



AMPCO METAL

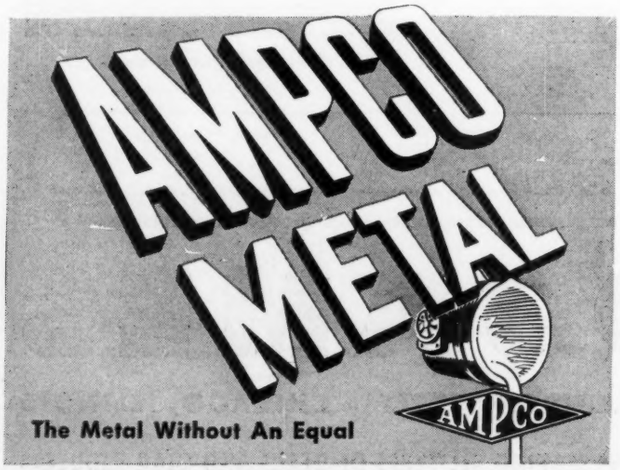
PROVIDES BOTH IN PUMP SERVICE

THE handling of corrosive liquids—the pumping of acid sludge, mine waters and other abrasive bearing liquids can work severe havoc with the "innards" of pumps.

Many users and manufacturers of reciprocating and centrifugal pumps use Ampco Metal for the vital parts because Ampco Metal's high corrosion resistance, hardness, and physical properties are fully equal to the most severe demands.

The complete facts are worth your investigation —write for "Ampco Alloys in Pump Service."

AMPCO METAL, INC., Dept. MD-11 Milwaukee, Wis.



tric controls are available in manual or automatic reset models for various types of mounting.

Dynamotors Have One-Piece Field

SMALL light weight, aircraft type dynamotors for aircraft, police and marine radio, are announced by the Carter Motor Co., 1610 Milwaukee avenue, Chicago. Made in two frame sizes, the motors weigh respectively 4½ and 7½ pounds. Outstanding features incorporated in both frames are a one-piece field ring simplifying construction and insuring perfect alignment; double enamel and silk wire on armatures to prevent shorts and grounds; a specially designed commutator with mica insulation extending beyond the copper bars at all points except where the brushes ride.

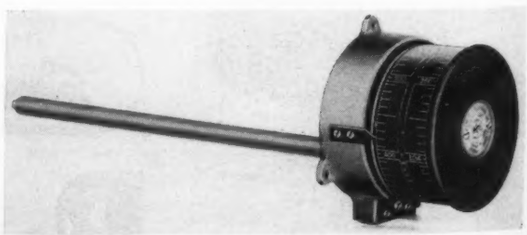
One-piece field ring in light weight dynamotors simplifies construction and insures perfect alignment

Weldrod Has Unusual Properties

ALUMINUM bronze in the form of a coated weldrod called Ampco-Weld is announced by Ampco Metal Inc., 1745 South Thirty-eighth street, Milwaukee. It is said to be a completely new metallurgical accomplishment. Tests have revealed unusual physical properties in comparison with older bronze welding materials. Hardness on the Rockwell B scale of 94 is attainable, against a former maximum of 90, while the ultimate tensile strength ranges up to 92,000 pounds per square inch, against 55,000 as formerly. Per cent elongation in two inches can be as little as .5 or as much as 24.5 with the new weldrod. Ampco-Weld has particular value for designers in parts where the bearing properties and corrosion resistance are desirable.

Thermostat on Market

WITH a temperature range from 70 to 600 degrees Fahr., a new thermostat is announced by Acme Electric Heating Co., 1217 Washington street, Boston. It can be operated horizontally or vertically without affecting the temperature setting or the index position and will operate without auxiliaries up to 1000 watts,



Temperature setting of the thermostat is unaffected by vertical or horizontal operation

Over 130,000 Sprockets in Stock

What a comforting thing to know in these days when delivery delays are the rule rather than the exception.

These more than one hundred thirty thousand sprockets are carried in stock for your convenience by us, our branches and our distributors who are located throughout the U. S. A.

Thousands of feet of chain for use with these sprockets are also carried in stock ready for your immediate use.

In our new general catalog No. 53, thirty-five pages are devoted to the subject of sprockets and chain wherein you will find complete specifications, list prices, horsepower capacities and also valuable information regarding the lubrication of chain drives.

Send for a copy of catalog No. 53 so you will know the thousands of items of power transmission equipment (sprockets and chain included) which can be obtained promptly from our stocks.

BOSTON GEAR WORKS, INC. NORTH QUINCY, MASS.

A Symbol of Perfection

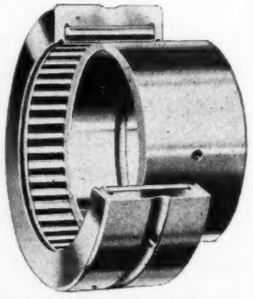
The metal plate shown above is a symbol of the perfection and quality built into the equipment to which it is attached. The name McGILL on a bearing is your assurance of real value and satisfaction in performance.

Universally Used

You will find McGILL Bearings, both ball and needle type, being used regularly in fine machinery — printing presses, motors, diesel engines, boring machines, generators, steam shovels, locomotives — in trucks — in automobiles. These precision bearings have demonstrated their ability to stand up, under a wide range of requirements over the years. They have incorporated in them features of construction not regularly found in other bearings, that result in economies in first cost, in installation cost, and in upkeep—benefits worth considering.

Write for further particulars.

New McGILL Maximum Capacity Ball Bearing



McGILL Solidend *MULTIROL* Bearing

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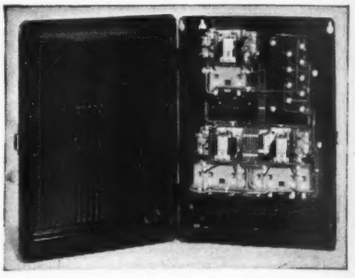
McGILL MANUFACTURING CO.
1450 N. Lafayette Street
VALPARAISO, INDIANA

either alternatng or direct current, 115 or 230 volts. The fast make and break mechanism is so mounted that it will not be affected by vibration.

Start Motor at Any Speed

FOR use with multispeed squirrel cage motors of from 1 to 100-horsepower, 220 to 600 volts, a line of across-the-line magnetic starters is announced by Westinghouse Electric & Mfg. Co., East Pittsburgh. These starters are designed to start the motor across the line at any speed. Different speeds are obtained by changing the connections to the motor so as to change its number of poles. Features include pushbutton speed

Magnetic starters start motor across the line for any speed, obtaining speeds by changing connections to vary number of poles



selection, accurate overload protection, low voltage protection, De-Ion arc quenchers, and front of board wiring with accessible terminals. All sizes are available in standard or dust-tight sheet steel enclosures. Smaller sizes are available in enclosures for Class II, Group G, and Class I, Group D hazardous locations.

Heat Rise Actuates Oiler

AUTOMATIC lubrication of solid, wick or waste-packed bearings is provided on the slightest temperature rise by a thermal bottle oiler announced by Trico Fuse Mfg. Co., 2948 North Fifth street, Milwaukee. As soon as the bearing receives a few drops of

Temperature rise causes oiler to lubricate bearings automatically, cooling then stopping flow

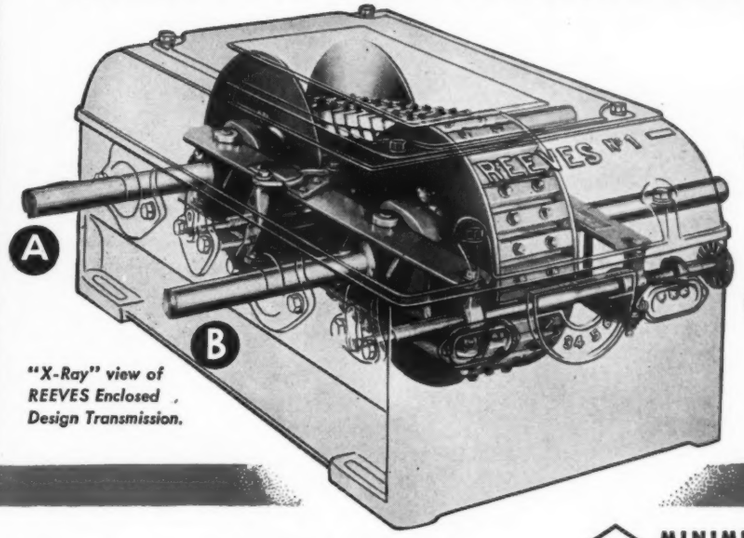
oil it cools and the feeding stops automatically, this operation repeating itself constantly. Feed can be adjusted by opening or closing a port hole. This oiler is made in one, two and four-ounce capacities.

Hose Made without Fabric

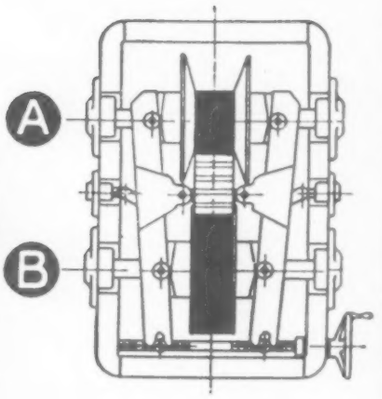
A SPECIAL line of hose for specialized, rigorous service is now being made from Koroseal, the synthetic elastic material made by the B. F. Goodrich Co., Akron, O. The new hose is made without fabric or any other wall reinforcement, being stocked in inside diameters ranging from ⅛ to ½-inch and 1/16 to ⅛-inch wall thickness, and can be made at present in all sizes up to 3-inch outside diameters. Made in dull black, the hose has durometer hardness of 70 to 78 at 85 degrees Fahr.; specific gravity, 1.31; working pressure 50 pounds at temperatures up to 120 degrees Fahr. Absolutely free from sulphur, the hose can be attached

THIS *time-tested* PRINCIPLE

BRINGS THE ADVANTAGES OF ACCURATE SPEED CONTROL TO 1,375 DIFFERENT MAKES OF MACHINES



"X-Ray" view of REEVES Enclosed Design Transmission.



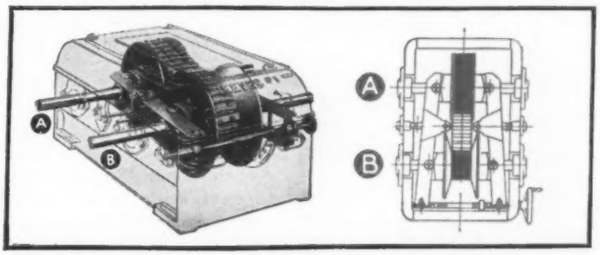
These diagrams show how the REEVES Variable Speed Transmission provides any driven machine with infinite speed adjustability. The rugged REEVES endless cord V-belt drives between two pairs of cone-faced discs which are adjustable to form an infinite number of driving and driven diameters. The discs are mounted on parallel shafts. One shaft receives power at constant speed from the motor. The other delivers power at infinitely adjustable speeds as the V-belt assumes different diameters of contact against each set of discs. Power is transmitted positively because of *non-slipping*, wedge-like action of belt. Equally important—any speed setting is maintained without fluctuation because belt tension is automatically controlled at *all* driving diameters. With this speed adjustability, positive and accurate over full range, a machine can be operated at greatest efficiency under every changing condition. . . . Find out how easily and inexpensively REEVES Speed Control may be applied to the machines you build. Nation-wide engineering service. Write us.

MINIMUM SPEED

On constant speed shaft "A," cone-faced discs and speed-changing levers are *farthest apart* while the V-belt runs at *smallest* diameter between the discs. On variable speed shaft "B" reverse is true and shaft runs at *minimum* speeds.

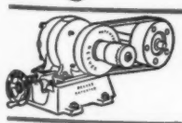
MAXIMUM SPEED

On constant speed shaft "A," cone-faced discs and speed-changing levers are *closest together* while the V-belt runs at *largest* diameter of the discs. On variable speed shaft "B" conditions are reversed and this shaft runs at *maximum* speed.

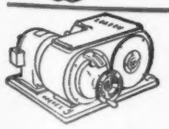


REEVES *Accurate Positive* SPEED CONTROL

VARIABLE SPEED TRANSMISSION for infinite speed control over wide range—2:1 to 16:1 inclusive—and for heavy duty service. Fractional to 78 h.p. Vertical and horizontal designs.



VARI-SPEED MOTOR PULLEY for direct application to shaft extension of any standard constant speed motor and for ratios of speed variation not exceeding 3:1 range. Fractional to 15 h.p.



MOTODRIVE—combines motor, variable speed drive and gear reducer (if needed) in single compact unit. To 10 h.p., speed range 2:1 through 6:1.

Send for This Helpful Manual and Catalog

REEVES PULLEY CO.,
Dept. H, Columbus, Ind.
Please send copy of your 124-page book, containing engineering data.

Name .....
Firm .....
Dept .....
Address .....

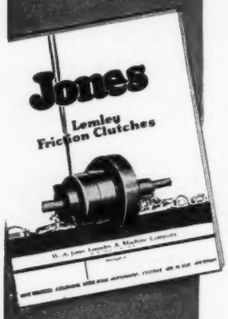
Jones-Lemley Friction Clutches

WHEN you want a clutch you want one that takes hold with a death grip and yet eases into the load with the smoothness of a stream-lined Zephyr.

Jones-Lemley friction clutches come right up to these specifications. In addition they have attractive lines plus that sturdy "stand-up-and-take-it" design that is a feature of every Jones transmission product.

These clutches are built in a broad range of shaft sizes and ratings in both enclosed and open types for sleeve and coupling work. In addition they are available in a line of Jones-Lemley friction clutch pulleys in diameters from 12 inches to 48 inches in face widths up to 24 inches. This clutch modification is also used for gears, V-belt sheaves, sprocket wheels, etc.

The Jones engineering department has had a broad background of experience in handling all types of clutch applications. They will be glad to offer suggestions on any clutch problem you may have.



COMPLETE CLUTCH INFORMATION

Sizes, ratings, dimensions, prices and other data are contained in Bulletin No. 60 covering Jones-Lemley friction clutches and clutch pulleys.

WRITE FOR YOUR COPY

W. A. JONES FOUNDRY & MACHINE CO.
4413 Roosevelt Road, Chicago, Illinois

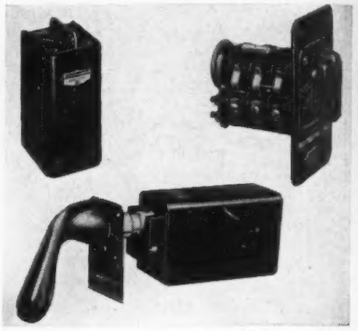
Since 1890
Jones

HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS
CUT AND MOLDED TOOTH GEARS — V-BELT SHEAVES
ANTI-FRICTION PILLOW BLOCKS — PULLEYS
FRICTION CLUTCHES AND TRANSMISSION APPLIANCES

to brass, silver, etc., without corrosion of the metal. It does not swell in oil or solvents of rubber, is not affected by strong corrosives, is practically impermeable to gas diffusion and does not absorb moisture. Applications include friction roll coverings for business machines and recording instruments, and many uses in photographic and printing machinery.

Master Switch on Market

THREE-WIRE control is provided by a drum type master switch announced by Cutler-Hammer Inc., Milwaukee. It affords functions equivalent to two and three-button heavy duty pushbutton stations and is offered for use where an operating lever is preferred. Surface, cavity and panel mounting constructions are

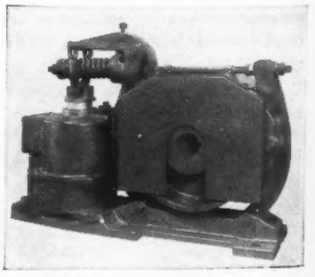


Functions equivalent to those of heavy duty pushbutton stations are said to be afforded by three-wire master switch

available, with two kinds of handles, standard and pistol grip. By removing a stop post the drum may be converted from nonreversing to reversing. Ratings are for pilot circuits up to 600 volts alternating and direct current.

Brake Withstands Salt Water

AN ADDITION to its line of standard industrial direct current magnetic brakes is announced by Westinghouse Electric & Mfg. Co., East Pittsburgh. Known as the type DW marine brake, the unit provides a magnetic brake capable of withstanding salt water action in marine service. It is available for operation on 115 and 230-volt direct current, with continuous duty torque ranges from 15 to 1350 pound-feet. These brakes



Magnetic brakes are designed primarily for application to motor shaft extensions

are designed primarily for application to motor shaft extensions, although they may be used where there is no motor. Shunt coils are standard and a low voltage coil and a series resistor are used to obtain fast operation.

Conduit Fitting Prevents Abrasion

EMBODYING a different principle of interior design, Form 37 conduit fittings are announced by the Adalet Mfg. Co., 1448 East Forty-ninth street, Cleveland. Smooth curves on the side of the fittings as

SAVES TIME . . . WORK . . . AND $1000 A YEAR
Operation – drilling castings for mounting conduit boxes.
Old method – manually lifted to drilling machine, then separate operation.
New method – drilled at same time as bracket holes, with synchronized control.
Results – faster production, no lifting, costs reduced $1,000 a year.
In this plant, production schedules and costs demanded a better method of drilling holes in castings for attaching conduit boxes. The existing method was too slow because it required manually lifting the heavy frames from the conveyor to the
The Profit
scheme
holes at the same time. This newer method gains time, relieves the operator of the heavy work—and saves $1,000 a year in costs.
If you are up against production schedules
to work? Possibly he can
a simple plan that will enable you to get more production from your present equipment—or can suggest new equipment
electric drives or controls are involved—Westinghouse has the facilities and the experience to do that part of the job for you.
WHAT IS A "PROFIT ENGINEER"?
He is a man with the ability to find ways of doing a job better, quicker, or cheaper. He may be someone in your own organization—or a salesman calling on you. Or—he may be an executive who knows a good idea when he sees it—and who provides authority and means to turn the idea into a profitable investment.
Are you a PROFIT ENGINEER?
J-94389
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, EAST PITTSBURGH, PA.
This advertisement appears in BUSINESS WEEK on September 28, 1940
Westinghouse
ELECTRICAL PARTNER OF INDUSTRY
W
WESTINGHOUSE ELECTRIC

One of a series of Westinghouse advertisements in Business Week, pointing out how you can increase production by a more practical application of electrical equipment.

TO RELIEVE BOTTLENECKS

The job of getting more work out of production machinery is not new to us. We've been doing it in our own plants for fifty years. And, during that time, we've been helping others in American industry to do the same job.

So—if you're hard pressed to meet the present emergency, perhaps we can help you. Or, if it's a case of getting more work out of machines you are building for your customers, we can help in that, too.

Whatever the job may be—if you feel that a better application of electricity might do it, we'll be glad to lend a hand.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
EAST PITTSBURGH, PA.

Tune in "Musical Americana," N. B. C. Red Network, Coast-to-Coast, every Thursday evening.

J-94401

In the Acme Machinery Division of the Hill Acme Company, engineers seek constantly to improve the performance of their machines. They found in Ohio Gears, the exact qualities they needed to insure the precision, the ruggedness, the smooth, quiet operation and the economy that have characterized Acme Threading Machines for half a century.

These wide faced, large diameter, chrome-nickel steel gears are machined to precise Acme specifications. They provide 8 speed changes quickly, quietly, positively. They assure Acme users a long life of accurate, trouble-free threading machine service.

Like Acme engineers, you too, will find in Ohio Gears, a definite contribution to the efficiency and economy of the machines you are building. Ohio Gear engineering service will assist you in solving knotty power transmission problems. Write or phone the nearest representative today.

THE OHIO GEAR CO.
1338 E. 179th Street • Cleveland, Ohio

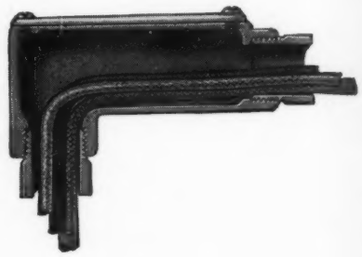
Representatives

*NEW YORK CITY, N. Y.
Patron Transmission Co.
154-156 Grand Street
NEW ENGLAND George G. Pragst
260 Esten Ave., Pawtucket, R. I.
*LOS ANGELES, CALIF.
J. W. Minder Chain & Gear Co.
927 Santa Fe Avenue
GRAND RAPIDS, MICH.
W. H. Slaughter
419 Oakdale St., S. E.
*PITTSBURGH, PA.
Standard Machinists Supply Co.
South 2nd and McKean Street
DETROIT, MICH.
George P. Coulter
322 Curtiss Building
*MINNEAPOLIS, MINN.
Industrial Supply Co.
537 S. Seventh St.
BUFFALO, N. Y.
F. E. Allen, 2655 Main St.
*KANSAS CITY, MO.
Kansas City Rubber & Belting Co.
712 Delaware Street
*SAN FRANCISCO, CALIF.
Adam-Hill Co.
244-246 Ninth St.
LOUISVILLE, KY.
Alfred Halliday, 330 Starks Bldg.
*INDIANAPOLIS, IND.
A. R. Young
518 North Delaware Street
ST. LOUIS, MO.
St. Louis Tool Co.
2319 N. Ninth Street

Stocks carried.

OHIO GEARS

shown in the illustration prevent abrasion or cracking or cutting of the insulation. The radii of the conduit hub bell-mouth curves are in accordance with wire manufacturers' specifications.



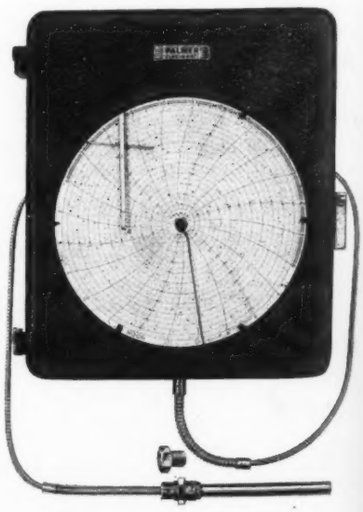
Smooth curves on inside of conduit fittings prevent abrasion, cracking

Counter Has No Minimum Count

COUNTING at rates up to 2000 per minute is possible with an electronic counter announced by the Shallcross Mfg. Co., Collingdale, Pa. This device multiplies by five the count as indicated on a registering counter. An outstanding feature of the instrument is the fact no minimum count per minute is required. It will count accurately, following all variations. The No. 475 counter operates from the regular 110-120 volt, 60-cycle lines.

Thermometers Announced

TWO thermometers designed especially for processing machinery are announced by the Palmer Co., 2501 Norwood avenue, Cincinnati. The mercury-actuated recording model, shown, has an easy-filling pen and a Perma-seal door lock. The new Superior dial thermometer, mercury-actuated, has an 8-inch case with a nonreflecting white dial.



Designed especially for processing machinery, mercury-actuated thermometers are on market

Magnetic, Thermal Trip Combined

COMBINING in a single unit a co-operative magnetic and thermal trip, the "Quicklag" circuit breaker is announced by Westinghouse Electric & Mfg. Co., East Pittsburgh. It is available in ratings of 15 to 35 amperes,

USE "LOGAN" EXPERIENCE ON YOUR SHELL HOLDING EQUIPMENT ★ ★ ★ ★

★

FOR over twenty years "LOGAN" has made air and hydraulic operated holding devices for all sizes and types of shells or similar forgings—but to the best of our knowledge this is the first time drawings and data of this type have been assembled and made available for general use. "LOGAN" Collet Chucks and "LOGAN" Expanding Mandrels illustrated in this new bulletin have been tested in actual daily service with excellent results. You can't afford to turn down the advantages of "LOGAN'S" experience on Shell Holding Equipment. Write today for the new "LOGAN" Air and Hydraulic Operated Shell Holding Bulletin.

★

LOGANSPORT MACHINE, INCORPORATED

911 PAYSON ROAD, LOGANSPORT, INDIANA

Manufacturers of Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accesssories

DESIGN ON PARADE

In just the same way that "A man's judgment is no better than his information," so is a nation no better than the machines it develops and uses. History has repeatedly proved this fact. The progress of any country can be measured by the mechanical ingenuity it demonstrates.

It is the machine that defends man against any enemy that seeks to destroy his civilized state. This same mechanical servant—the machine—also is indispensable in the private lives of individuals, saving endless toil in everyday tasks. The machine provides hours of recreation which otherwise would be consumed by monotonous labor, both in industry and the home.

Behind this mechanical vista are the designers at their boards working out new ideas and improving old ones. Society owes its high standard of living to these engineers. MACHINE DESIGN is proud to be the recognized professional journal of this important group. It is constantly aware of its obligation in serving as a clearing house for ideas and information covering the application of parts and materials used in the design of all types and sizes of machinery.

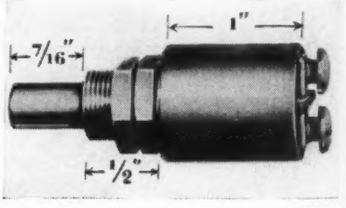
single pole only, 250 volts alternating current and 125 volts direct current. The combination of the bimetal thermal and the magnetic trip actions gives the new

Instantaneous trip on short circuits is combined with time delay for momentary overloads in circuit breaker

device the advantage of instantaneous trip on short circuits combined with the well-known advantage of time delay for momentary overloads.

Switch Widely Adaptable

A LIGHT weight switch known as the "Clicker" switch is announced by Robert Hetherington & Son, Sharon Hill, Pa. Weighing only ⅝-ounce, it will easily take a ¾-horsepower motor and is rated at 110 volts, 6 amperes inductive load, alternating current. It has 7/32-inch travel and the same overtravel. Two



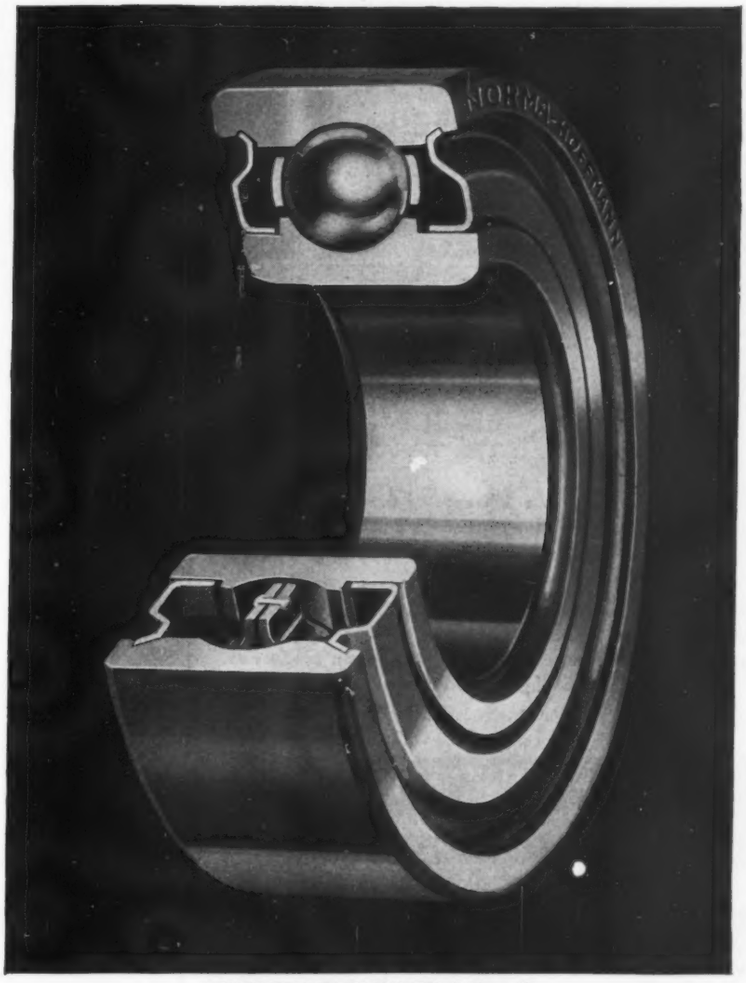
Although made originally for aircraft, light weight switch is adaptable to industrial uses

¼-inch silver contact buttons provide make and break on two strips of solid silver. Designed originally for aircraft, this switch is equally adaptable for industrial uses, particularly for limit work. It is furnished either normally open or normally closed and for special uses can be furnished in singe pole, double throw type, and single throw, double pole.

Tape Reinforces Plastic Packing

A NEW development in the manufacture of Super-Seal plastic packing is announced by the Crane Packing Co., 1800 Cuyler avenue, Chicago. It is now being made with a patented tape back reinforcement securely vulcanized to the outer surface of the packing. This vulcanized tape reinforcement replaces the old frictional woven cotton jacket and now a nonfrictional surface bears directly against the moving part. Because of the new reinforcement, the packing is extremely pliable and can be bent around small diameter rods and shafts without fracturing or cracking, or formed into small inner diameter rings without distortion. Super-Seal is a dry-graphitized plastic packing made from pure long-fiber asbestos, antifrictional metal particles and special binders. It contains no oils that can be driven off by heat or pressure and the packing flows easily under gland adjustment. It is recommended for centrifugal and rotary services and comes in six styles for special services. Each of the types

The "9000-DD" Precision Ball Bearing, with Double Metal Seals, is here shown; also furnished as "9000-D" with Single Metal Seal.



LARGER GREASE CAPACITY • NO SEAL DRAG

"9000" SERIES (Feltless)

SELF-SEALED BEARINGS

Interchangeable in dimensions with conventional felt seal (and felt seal with enclosing shield) bearings.

Employs simplified, inwardly extending, flanged metal shields which do not rotate and cannot "foul" other rotating seal parts.

Seals are rigidly held in outer ring and are highly efficient in retaining grease in either horizontal or vertical position.

Simple seal occupies less space within bearing than felt seal, PROVIDING GREATER GREASE CAPACITY AND A MORE LASTING LUBRICANT SUPPLY.

Metal seals clear recess on inner ring, ELIMINATING "DRAG" OR FRICTIONAL RESISTANCE and power loss, and providing higher starting speeds and increased efficiency.

Totally sealed against entrance of dirt or foreign matter during manufacturing operations, assembly or disassembly, providing absolute cleanliness at all times.

Close fitting metal shields are not subject to any wear whatsoever, and therefore permanently maintain their efficiency.

Write for the Catalog. Let our engineers work with you.

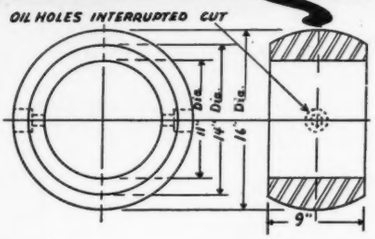
"NORMA-HOFFMANN"

PRECISION BEARINGS

BALL, ROLLER AND THRUST

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U.S.A.

HOW KENNAMETAL TOOLS
Permit CLOSER-FITTING Parts
with decreased production costs



The drawing at the right illustrates a bearing shell made of Hadfield manganese steel which was turned and bored by two KENNAMETAL-tipped tools with a tolerance of 0.015" on diameter, as compared to a tolerance of 0.100" when high speed steel tools were used. The increased accuracy after machining with KENNAMETAL saved from 2 to 3 hours production time by eliminating the necessity of grinding.

Let us show you how the use of KENNAMETAL steel-cutting carbide tools in your machine shop enables you to specify harder steel parts of greater accuracy—while holding down production costs. Send us B/Ps showing desired tolerance and material to be machined.

McKENNA METALS Co.
146 LLOYD AVENUE
LATROBE, PENNSYLVANIA, U.S.A.

BLUE Devil
The ARISTOCRAT of SOCKET SCREWS

Try our service on your special sizes.

1—Cold-formed heads—unimpaired continuity of fibres.

2—Tensile strength 215-225,000 lbs. per square inch.

3—Precision formed hexagon socket with true sides and no taper.

4—Chamfered edge knurled to facilitate assembly.

Blue Devil Cap Screws are unbelievably tough, and are heat treated in electrically controlled furnaces. Send for catalogue and samples.

Nothing too large - Nothing too small for
SAFETY SOCKET SCREW CORPORATION
4447 N. KNOX AVE., CHICAGO, ILLINOIS

is available in sizes from ¼ to 1-inch, graduated by sixteenths.

Regulator Controls Voltage

FOR automatic voltage control of small alternating and direct current generators, a quick-acting rheostatic type regulator has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh. Known as the Silverstat Junior regulator, it is available in direct current ratings up to 25 kilowatts and alternating current ratings up to 44 kilovolt amperes. This regulator performs continuously the same operation as that obtained by manual operation of the field

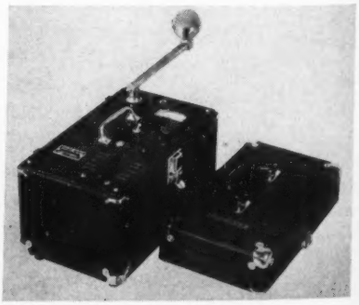
Regulator performs same function as that obtained by manual operation of field rheostat

rheostat of a machine under hand control. The voltage of the machine to be regulated is connected across the regulator coil and any change in voltage results in a corresponding change in the magnetizing effect of the coil on the magnetic circuit. Attractive force on an armature will be increased or decreased, causing the armature to seek a new position. This will short out or insert a resistor in series with generator.

Engineering Dept. Equipment

Noise Meter Has Wide Range

A PORTABLE sound-level meter, weighing only 19 pounds but with a range of 24 to 120 decibels, is announced by the General Electric Co., Schenectady. The new meter may be used quickly and conveniently for almost any kind of noise study. Essential parts are



Wide range of ninety-six decibels is afforded in portable sound-level meter

a microphone, an amplifier and an indicating instrument. A switch permits the selection of one of three ear-weighting networks, 40 decibels, 70 decibels or flat frequency response giving the instrument a response similar to that of the human ear.

Vibration Measured Electronically

FOR electronic measurement of vibration, the Model 11 Vibrometer is announced by Televisco Products Inc., 2400 North Sheffield boulevard, Chicago. The instrument is not delicate, will withstand hard usage and

Teamwork..

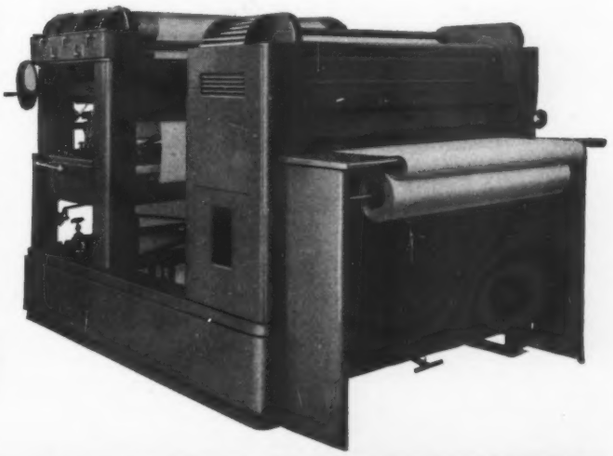
IN NATIONAL DEFENSE IS COORDINATED BY BLUEPRINTS

When unusual demands are put upon many industries working toward a common goal, each one has to gear its production to the next. There can be no weak links or the finished product will be delayed.

Now, in this National emergency, with so many specialized products on order, there are thousands of new designs and redesigns which must be drawn out in the drafting room and transmitted to the shop. Blueprints are the simplest and most satisfactory method of reproducing these engineering drawings.

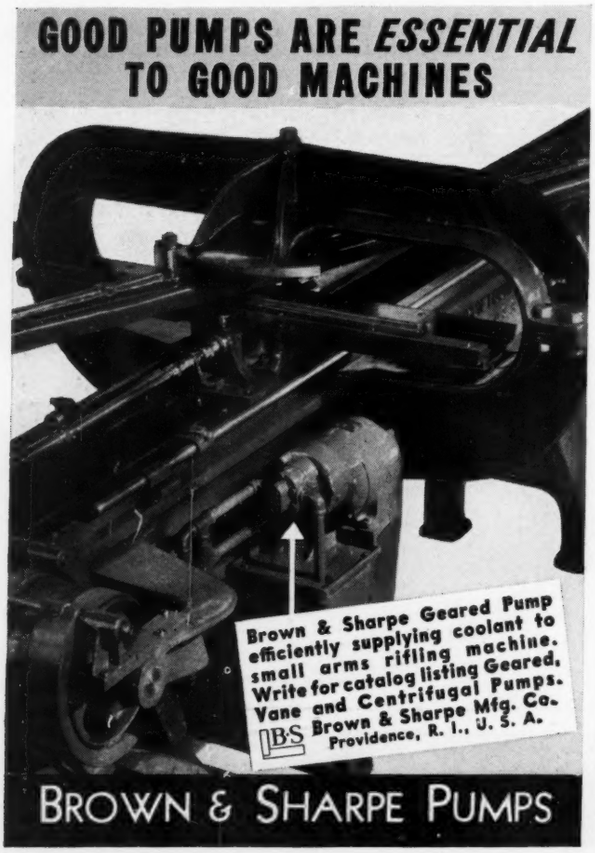
The C. F. Pease Company—for 30 years the leader in the Blueprinting Industry — has upped its production of Quality Blueprinting Machines by operating night shifts in its new, modern plant. Additional space is being planned and new improvements are constantly being built into every machine, in an effort to strengthen the reproduction link in the Defense Program.

The Pease Company is proud to be a part of the great National plan to maintain Peace, and toward this end will continue to furnish the finest Blueprinting Equipment available.



THE C. F. PEASE COMPANY
2606 West Irving Park Road • • • Chicago, Illinois

SNAP-LOCK
SWITCH
No. 160-1200-
THE NATIONAL ACME CO.
CLEVELAND, OHIO
MADE IN U.S.A.
Has your shop a limit switch "trouble spot"?
Try a Snap-Lock replacement on your toughest job, or build one in. Prove for yourself the experience of 500 others — millions of trouble-free contacts.
Our "Startling Facts" folder tells the whole story, and offers FREE TRIAL — entirely our risk. Write today.
THE NATIONAL ACME CO., Cleveland, Ohio


GOOD PUMPS ARE ESSENTIAL TO GOOD MACHINES
Brown & Sharpe Geared Pump efficiently supplying coolant to small arms rifling machine. Write for catalog listing Geared, Vane and Centrifugal Pumps.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
BROWN & SHARPE PUMPS

its indications are not affected by noise or extraneous agitations. The rugged 9-inch meter accurately indicates amplitude of vibrations regardless of frequency or prod pressure.

Vibrometer will withstand hard usage and is not affected by noise

Negative Assures Duplication

A NEGATIVE medium that assures identical duplications is announced by the Frederick Post Co., P. O. Box 803, Chicago. Known as No. 226 Philm, it has a glossy backing that resists dust and dirt. It gives best results when used as a negative medium for ink drawings or pencil drawings with "ink-like" detail. No. 226 Philm is available in 20-yard rolls, 36, 42 and 54 inches, and in 10-yard rolls of the same widths.

Meetings and Expositions

Dec. 2-6—

American Society of Agricultural Engineers. Semiannual meeting to be held at Stevens Hotel, Chicago. Raymond Olney, St. Joseph, Mich., is secretary.

Dec. 2-6—

American Society of Mechanical Engineers. Annual meeting to be held at Hotel Astor, New York. The banquet will be held Dec. 4. C. E. Davies, 29 West Thirty-ninth street, New York, is secretary.

Dec.2-7—

National Power Show. Fourteenth exposition to be held at Grand Central Palace, New York. Information may be obtained from the 14th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York.

Dec. 4-6—

Institute of Cooking and Heating Appliance Manufacturers. Annual meeting and exposition to be held at Netherlands Plaza Hotel, Cincinnati. Samuel Dunckel, Shoreham Hotel, Washington, is managing director.

Dec. 5—

Aeronautical Chamber of Commerce of America Inc. Annual meeting to be held in New York. Oliver L. Parks, 729 Fifteenth street, N. W., Washington, is secretary.

Jan. 27-31—

American Institute of Electrical Engineers. Annual winter convention to be held at Philadelphia. H. H. Henline, 33 West Thirty-ninth street, New York, is secretary.

Jan. 27-31—

National Association of Air Filter Manufacturers. Annual meeting and exhibition to be held. Additional information may be obtained from J. R. McConnell, 215 Central avenue, Louisville, Ky.

AVAILABLE

A limited number of copies of MACHINE DESIGN's 1940-1941 Directory of Materials are available. More than 500 different materials in scores of grades used in the design of machinery, are listed, briefly described, and their makers indicated.

The Directory is divided into nine convenient sections: iron, steel and nonferrous alloys; plastics and other nonmetallics; iron, steel and nonferrous alloy producers; plastics and nonmetallics producers; stampings producers; forgings producers; die castings producers; custom molders; and producers of machine finishes.

Each listing of material has a helpful key to principal characteristics, permitting quick and easy reference to those materials for which an engineer may be searching. Below is a scale of prices for quantities. Single copies are twenty-five cents, postpaid.

10 Copies @ 20c per Copy	$2.00 Postpaid
25 Copies @ 18c per Copy	4.50 Postpaid
50 Copies @ 16c per Copy	8.00 Postpaid
100 Copies @ 15c per Copy	15.00 Postpaid

Send all orders to MACHINE DESIGN, Book Department, 1213 West Third Street, Cleveland, Ohio.

LEADERSHIP!

For temperature control—

MINNEAPOLIS-HONEYWELL product relies on WILCO

Of course world leader Minneapolis-Honeywell seeks the best possible thermostatic bi-metals for such outstanding products as its new, completely automatic Chronotherm wall thermostat. And *of course* this top quality firm uses Wilco as a source of supply for these important thermostatic bi-metals.

Through more than 26 years of pioneering research and careful craftsmanship, Wilco has been accepted everywhere as the standard of sensitivity, accuracy and dependability among thermostatic bi-metals. For a solution of *your* problem, write for "Wilco Blue Book of Thermometals and Electrical Contacts."

THE H. A. WILSON CO., 105 CHESTNUT ST., NEWARK, N. J.
Branches: Detroit, Mich. and Chicago, Ill.

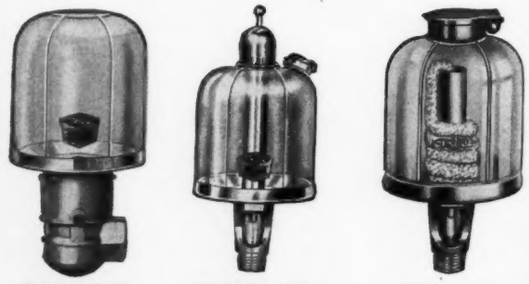
WILCO THERMOMETAL
(Thermostatic Bi-Metal)

OILERS

ALL SIZES

Glass and Unbreakable Types

TRICO visible automatic lubrication is the ultra-modern way to stop waste and failures caused by old-fashioned trust-to-luck hand oiling methods.



OPTO-MATIC GRAVITY FEED WICK FEED

DRIP-DROP

LEVOMATIC OPTO-MATIC

TRICO REG. U. S. PAT. OFF.

WRITE FOR BULLETINS

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

Patent Claims Are Vital

(*Concluded from Page* 57)

end thereof and an inertia valve controlling said duct.

The provision of the duct extending through the piston from end to end thereof may be omitted in a competitor's device by arranging the flow duct through the cylinder casing as shown in the shock absorber of *Fig.* 4. The construction of *Fig.* 4 does not infringe Claim 8. If this claim were rewritten as Claim 9 below, the shock absorber in *Fig.* 4 would infringe the claim, which reads:

> I claim as my invention:
>
> 9. A shock absorber comprising, in combination, a cylinder, a piston therein adapted to form liquid chambers between opposite ends thereof and the opposite ends of the cylinder, a flow duct arranged to connect said chambers, and an inertia valve controlling said duct.

Hole Is Not Direct Claim

A "hole" cannot be claimed positively because it is the absence of something. An invention to be claimed accurately must not be claimed by what it is not. Thus, it would be improper to write Claim 10 for the shock absorber in *Fig.* 3 as follows:

> I claim as my invention:
>
> 10. A shock absorber comprising, in combination, a cylinder a piston therein adapted to form liquid chambers between opposite ends thereof and opposite ends of the cylinder, a *hole* connecting said chambers, and an inertia valve controlling said hole.

A hole is to be distinguished from the structure around the hole. Thus, it is permissible to claim a *flow duct* as found in Claims 8 and 9, because a duct constitutes the surface around the hole. Although a hole cannot be properly claimed positively, yet it may be set forth indirectly. Thus, it is proper to state, for example, in a claim—a piston having a hole, etc.—because here the phrase "having a hole" qualifies the type of piston, as distinguished from claiming the hole positively.

Expand for Rearmament

PLANT expansion, in anticipation of the rearmament program requirements, is going forward rapidly in many far-seeing organizations. Typical of those companies not waiting for contemplated legislation are the Glenn L. Martin Co. and Stewart-Warner Corp. who have recently announced plans to increase facilities. The former company will add 400,000 square feet of manufacturing space involving nearly $1,000,000 in new machinery and equipment and the latter is purchasing nearly a half-million in new machinery alone.

1. "WE GOT A PUMP AND MOTOR in by ship the other day that were completely soaked with water. I don't know how they got that way — maybe somebody even dropped 'em overboard when they were being loaded. All I know is that the motor wouldn't work."

2. "I SQUAWKED PLENTY ABOUT IT to the local G-E office. It burnt me up to see that motor sitting there on the floor — useless."

3. "IMAGINE MY SURPRISE when a guy showed up from a G-E service shop less than an hour later. He must have started over here almost before I finished talking."

WHEN a machinery manufacturer sells his product equipped with G-E motors and control, the complete service facilities of the G-E organization are available to his customer. Here is a true story which illustrates this point. It is a typical example of the attention anyone gets when he buys G-E equipped machines.

No matter where your customer may be located, there's always a G-E representative nearby to help him with his electrical problems. He can call on the nearest of 103 sales offices, 25 service shops, and 28 warehouses in all parts of the country. This service is just one of the many benefits that your customers get when you supply G-E equipment.

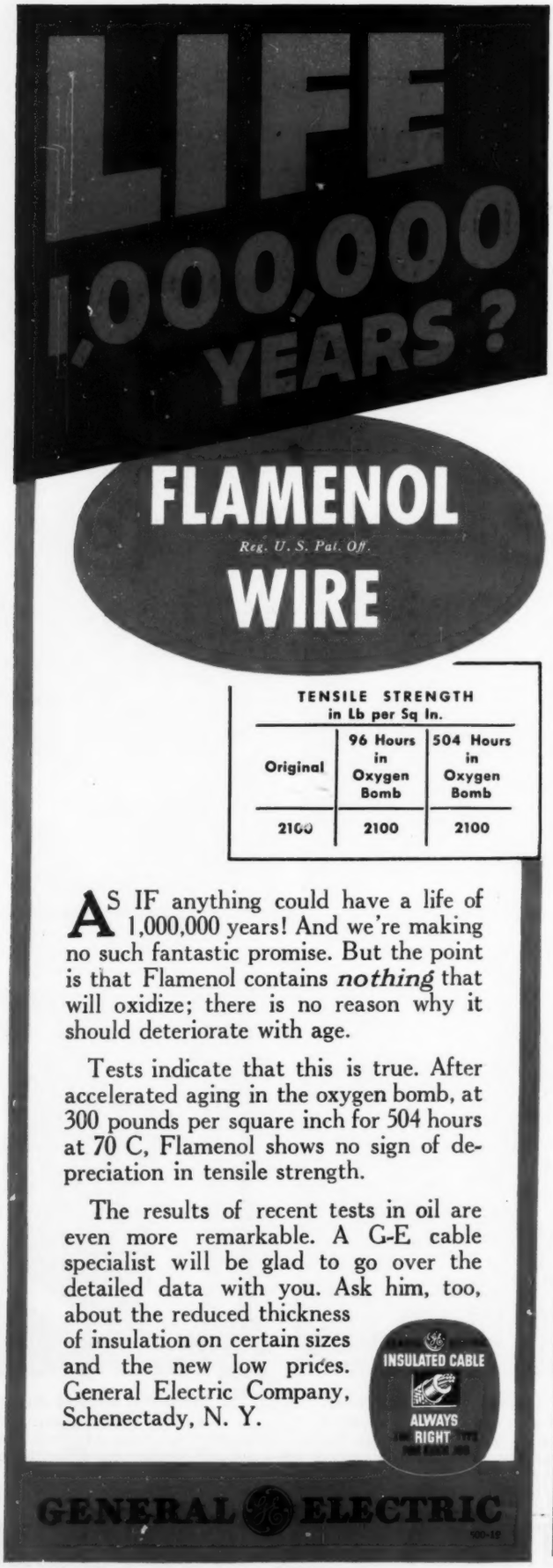
And if you have any electrical design problems, you can go to the nearest G-E office and get the help you need. General Electric, Schenectady, N. Y.

4. "HE KNEW WHAT TO DO right away. Took the motor apart and found two quarts of sea water inside. So he rushed it to the G-E service shop, and they baked it out in one of their electric ovens."

5. WE GOT IT BACK IN JIG TIME, and now it runs like a million bucks. I've never seen such service. I was pretty hot under the collar when I first saw that motor, but I sure cooled off fast when G.E. got going!

GENERAL ELECTRIC

669-2


LIFE
1,000,000
YEARS ?
FLAMENOL
Reg. U. S. Pat. Off.
WIRE
TENSILE STRENGTH
in Lb per Sq In.
Original
96 Hours in Oxygen Bomb
504 Hours in Oxygen Bomb
2100
2100
2100
AS IF anything could have a life of 1,000,000 years! And we're making no such fantastic promise. But the point is that Flamenol contains nothing that will oxidize; there is no reason why it should deteriorate with age.
Tests indicate that this is true. After accelerated aging in the oxygen bomb, at 300 pounds per square inch for 504 hours at 70 C, Flamenol shows no sign of depreciation in tensile strength.
The results of recent tests in oil are even more remarkable. A G-E cable specialist will be glad to go over the detailed data with you. Ask him, too, about the reduced thickness of insulation on certain sizes and the new low prices. General Electric Company, Schenectady, N. Y.
INSULATED CABLE
ALWAYS RIGHT
GENERAL ELECTRIC

Obtaining Accuracy, High Speed in Welder

(*Continued from Page* 41)

times the upset pressure except where back-up stops may be used. As a close approximation, the upset pressure ratio rises directly proportional to the tensile strength for ferrous stock. Considering this same factor for nonferrous stock the ratio might be said to be inversely proportional. Extremely high pressures are needed to stop metals such as stainless steel and brass from slipping because of the low coefficients of friction of these metals and the speed of welding required.

Pressures required to carry current from the lower dies to the stock to be welded are usually a factor that does not have to be considered because the clamping pressures necessary to hold the stock are far higher than those of the current factor. To arrive at these pressures, a toggle, *Figs.* 1 and 2, is employed, actuated by double-acting air cylinders. Air proves advantageous in most respects over any other means of power. Air supplies the quick action needed to speed up operations and may be used for extremely high clamping pressures.

Each Cam Generated Specially

The automatic cam pushup mechanism is enclosed entirely from dust and air yet, at the same time, is easily accessible by removing the enclosure covers. The drive, *Fig.* 4, is through a 1½-horsepower motor, mounted on the right-hand side of the machine and controlled by a motor starter, through a variable speed pulley unit to the worm gear reducer; then through the upset cam to the movable platen. A convenient adjustment is provided between the movable platen and the upset cam to permit various openings between the two platens. The upset cam is also totally enclosed in a special cover to protect flash and dirt from building up on the cam face.

Each flash and upset cam is generated to suit the physical, chemical and electrical properties along with the specific heat required at different temperature changes of the material in question. By this cam design, all foreign materials are discharged through the flash before upsetting takes place. The cam is machined steel with an inserted upset block. This upset block is of hardened tool steel of sufficient size to withstand the constant wear at the extremely high upset pressures used. In general, 10,000 pounds for each square inch of area is used for upsetting.

In operation, with the component parts being welded in their respective welding dies, air is admitted into the clamping cylinders. These cylinders actuate the clamping arms directly or indirectly through the toggle and lever arrangement as the welding application demands. After the work is fully clamped the operator closes a momentary contact switch that initiates the motor start switch. All switches are

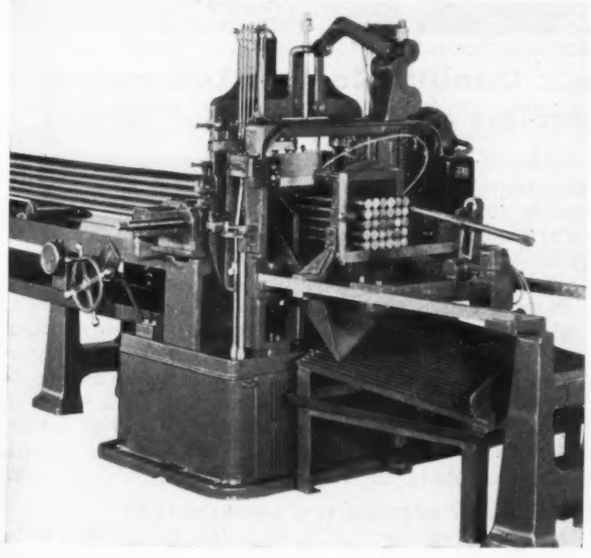
mounted conveniently on a control panel in front of the operator.

As the cam and camshaft, *Fig.* 5, start to revolve, a secondary control cam initiates a limit switch, thus closing the transformer contactor. The flash and upset cam then controls the complete welding cycle and is automatically stopped after each complete revolution by another secondary control cam opening the motor circuit and closing a brake circuit. Both secondary control cams are adjustable and may be reached by a door in the drive cover. The welding current contactor is opened at the predetermined time after the upset block has made contact with the cam following roll.

After the drive has come to rest, the clamp may be opened by hand or automatically. When the completely welded unit has been removed from the welding dies, a hand valve controlling a single-acting cylinder returns the slide until the cam-follow-up roll makes physical contact with the dwell of the cam. Thus, one complete welding cycle is made. *Fig.* 6, a schematic wiring diagram, shows how the welding transformer, contactor, motor and solenoid valves are connected.

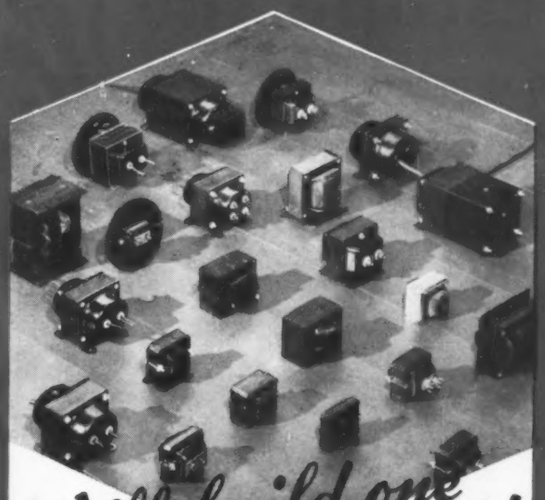
Feeds Stock Automatically

HYDRAULICALLY operated, the stock feeding mechanism on this metal sawing machine automatically advances the stock after the completion of each cut. Length of cut is preset and operation continues without attendant as long as stock remains. Steel sprockets mounted on both the forward and



rear ends of the automatic conveyor carry an endless length of roller chain. The conveyor feeds the stock forward to the length gage which is shown on the cut-off end of the machine. Acting as a limit switch, the length gage initiates the sequence operations required such as clamping, sawing, return of saw, unclamping and stock feed.

IF ONE OF THESE WON'T FIT YOUR PRODUCT



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1. Required transformer voltage and maximum regulation.
2. Tap voltages, and whether taps are for full or reduced kva capacity.
3. Duty cycle, maximum load current, power-factor, and frequency.
4. Mounting dimensions, type of wiring used, and type of case, if any.

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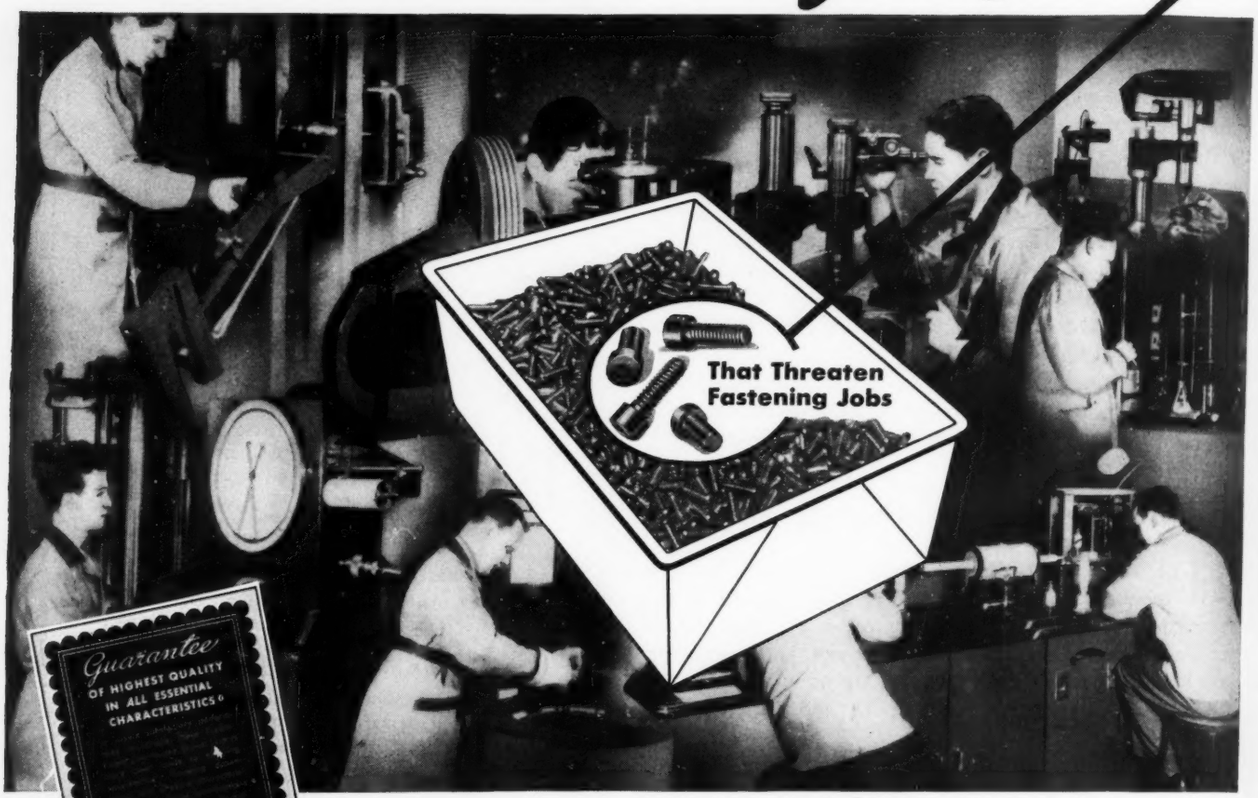

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To walk into the Parker-Kalon "Lab" is an amazing experience for any man. Nobody expects to find such complete and modern quality-control facilities in the screw industry. Often visitors who witness the routine which starts with analysis of raw material and ends with scientific tests of finished fastening devices, ask – "*Does all this have any practical value to the user?*"

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SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

Quality-Controlled **PARKER-KALON Fastening Devices**

Beneath That Streamlining

(*Continued from Page* 51)

siderails, a construction which is said to eliminate 400-500 pounds of weight from previous designs.

Coil springs are used on all four wheels of this model, with shock absorbers concentrically mounted inside the springs at the rear and parallel to the kingpins in the front. The Nash front suspension system employs 20-inch kingpins set vertically and supported at the top by a horizontal steel tube and at the bottom by a heavy bridge-type truss which is a part of the body and frame.

A smoothly polished collar rides up and down the lower section of each kingpin on six caged roller bearings, carrying the front wheel spindle at its lower end. The upper end supports the spring which in turn carries the body weight on a tapered roller bearing.

Ford Has Reduced Spring Frequency

Ford and Mercury have sought to give improved riding qualities in 1941 by redesigning both front and rear springs to give a lower frequency, by using reverse-type shackles, larger shock absorbers and an improved ride stabilizer. Front spring has 16 per cent lower frequency, one inch less camber and a lower deflection rate. Lower spring frequency is attributable mainly to the reversed shackles. On the 1940 model the lower ends of the shackles, to which the springs are attached, sloped inwardly toward the center of the car and approached the vertical position with full passenger load. With the new design the lower ends of the shackles slope outwardly at an angle of 25 to 30 degrees. This puts the main leaf of the spring in compression instead of tension and provides improved damping action.

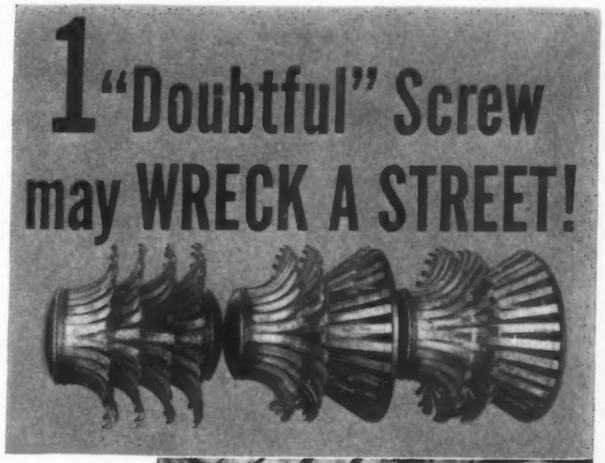
Rear springs are 1½ inches longer, but effective length has been increased another 2½ inches by reducing the clamping distance on the frame cross member from 6½ to 4 inches. Rear spring also has reversed shackles.

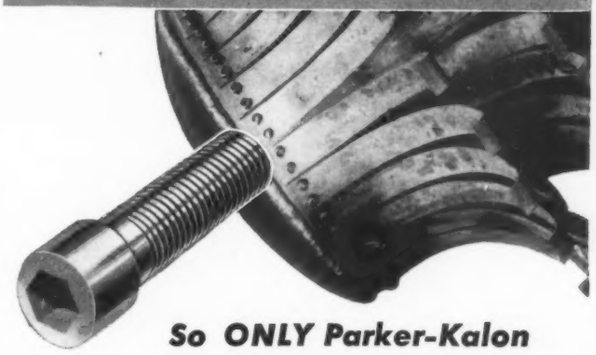
An improved type of ride stabilizer uses swinging shackle connections at the end of the bar in place of having the ends slide in bushings. The shackles swing back and forth through a small arc as the axle moves up and down. Closeup of this connection is shown in *Fig.* 7, as is the new front shock absorber which has 20 per cent added fluid capacity.

Windows Controlled Hydraulically

Solenoid valve controlled hydraulic operation is applied to the system of window lifts incorporated as standard equipment on Packard 180 models. The motor and pump unit include a 4-inch, 6-volt reversible motor with built-in direct connected gear pump which circulates hydraulic brake fluid under pressure to the operating mechanism in each door through metallic tubing and rubber hose connections.

Standard starter motor with four field coils especial-





So ONLY Parker-Kalon Quality-Controlled Socket Screws go into this Underground Pipe Cleaner

In cleaning forty inch water mains, enormous strains are put on the 840 Socket Head Cap Screws which hold the blades on this ingenious tool. It's no place for "doubtful" screws, as the Flexible Under-Ground Pipe-Cleaning Co. of Los Angeles makes clear:

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It is the final test of actual service like this that proves the practical value of Parker-Kalon's unequalled Quality-Control routine. Every design and production man who seeks protection against "doubtful" screws – screws which may look okay but of which a percentage fail in use – will find that protection in Parker-Kalon Screws. Want samples for test? Write: Parker-Kalon Corp., 192-200 Varick Street, New York.

Quality-Controlled

16-point test and inspection routine covers: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; Class 3 Fit Threads; Clean-starting Threads.

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ly wound with two coils for pressure or raising rotation and the other two for lowering rotation provide power for the system. A conventional gear pump is mounted in a die-cast housing which also forms one end frame of the motor.

A nonadjustable spring loaded maximum pressure regulating valve is fitted in the pump cover with a dashpot to prevent chatter. This valve operates to bypass fluid when the window reaches its upper limit, or when it strikes an obstruction.

Within each door is a cylinder and piston assembly connected to the conventional window regulator mechanism. The down stroke, produced by the vacuum created in the cylinder by withdrawal of air, is supplemented by a spring.

Double-acting control switches are provided for each window, the rear window switches being located above each arm rest, the front switches in each door. To raise any window the switch is moved to the "up" position which starts the motor and at the same time opens the solenoid valve in the line to the window to be raised, thus allowing oil under pressure to flow to the operating cylinder. To lower the window the control switch is moved to the "down" position, starting the motor in reverse direction, again opening the solenoid valve, thus withdrawing fluid from the cylinder to the reservoir.

Two solenoid operated switches are provided in the battery connection circuit, one for each pair of field windings, and with a relay to prevent the closing of both switches at the same time. Two or more windows may be operated simultaneously in the same direction, but not in opposite directions, and in all cases downward movement will dominate.

Unusual types of outside door handles are used on the new Lincoln Zephyr and Custom series, being of the pull type, a single motion sufficing both to release the door latch and swing the door open. Inside controls are of the pushbutton type, plastic buttons being flush with the door sides. On the Lincoln Continental series, pushbutton latches, flush with door surfaces, are used both inside and out, doing away with handles altogether.

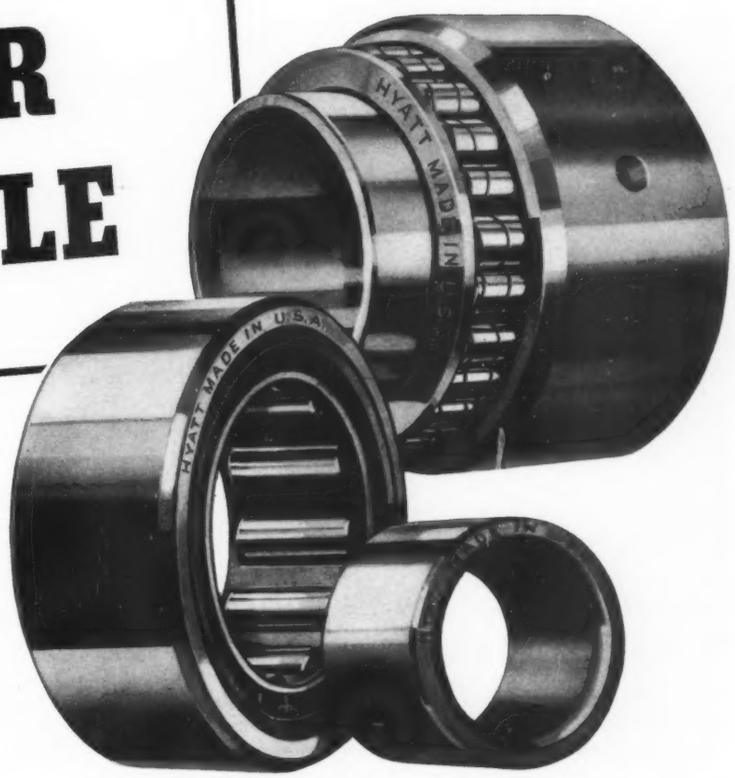
Use of Special Alloys Increases

With production being stepped up throughout industry, the strong trend toward the wider use of existing alloys and the development of new materials is now gaining tremendous strength.

Pronounced activity in the aircraft and armament industries is bringing about increased use of the high-strength, low-alloy, heat treated nickel steels for structural parts. These uses include tubing for engine mounts and landing gears, propeller blades, shafts and hubs, blade nuts, bolts, gears, connecting rods, etc. Excellent welding qualities as well as toughness at sub-zero temperatures are additional factors augmenting the use of low carbon, nickel alloy steels.

Automotive and aviation production is also adopting more nickel-chromium-molybdenum steel for stressed parts. These steels are often machined after heat treatment to 450 Brinell.

PROVING THEIR METTLE



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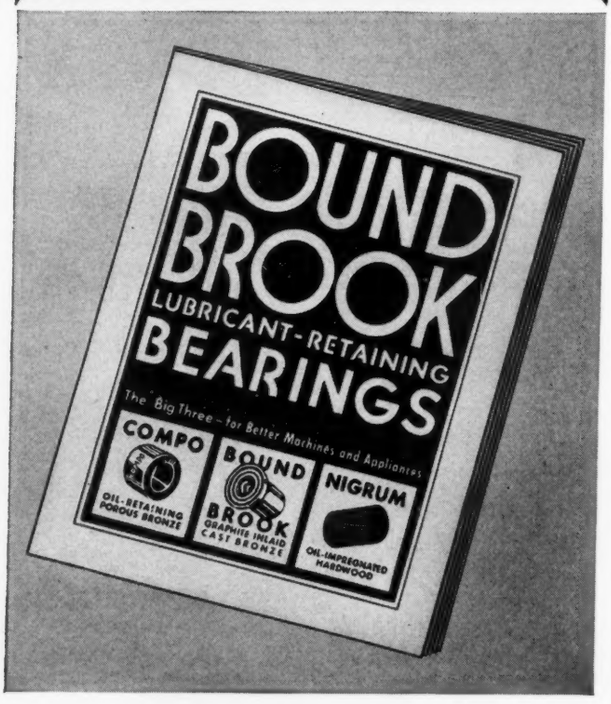

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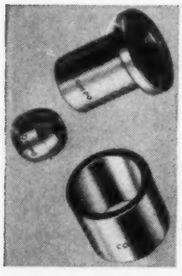
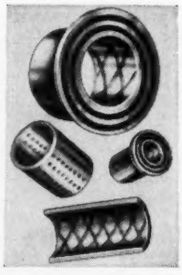
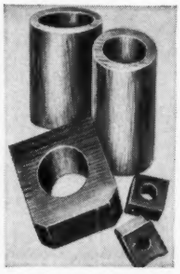


Compo Oil-Retaining Porous Bronze



Bound Brook Cast-Phosphor Bronze



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FOR BETTER MACHINES AND APPLIANCES

Topics

(*Concluded from Page* 36)

nine months of this year orders were 60 per cent over last year; commercial business alone, exclusive of government orders, increased 31 per cent.

♦

A NOTE on materials, (supplementing the information given in the October Materials issue): Corrosion of some alloys used in aircraft has been markedly reduced by methods developed by the bureau of standards in co-operation with manufacturers. Around 25,000 specimens of 60 different alloys were tested. Example of results tabulated: Small additions of tin or zinc render binary magnesium-aluminum alloys more resistant, while additional aluminum decreases resistance. Important data also was obtained on effects of exposure of different chemical compositions in contact with each other.

♦

ALTHOUGH the idea is strictly rumor, it has been hinted that Chrysler may cast—instead of fabricate from rolled plate—the armor for the tanks it is going to build in its new plant. Pouring of around 30,000 pounds of metal would be required for an armor section measuring 9 feet wide, 20 feet long, 4 feet deep, and from one to three inches thick. Cast armor "ain't been done" before, but that fact is not necessarily a deterrent.

Research Publications

The Pearlitic Structure of Low Manganese Steels, by H. E. Publow and D. D. McGrady. The authors begin by pointing out that the term pearlite is one of the poorly understood words which is used glibly by everyone, regardless of his knowledge about it. But since it is "the lamellar aggregate of ferrite and cementite resulting from the direct transformation of austenite," definitions of ferrite and cementite immediately become neccesary also, and they are given. Actually the paper is a summary of the best available work in the field, and quotations are liberal from many researchers. The amount of knowledge still to be gained is evidenced by the fact different researchers have formed different conclusions about the precise effect of manganese on steel. Conclusion reached is that "there is evidence that in a .6 per cent carbon steel an increase in manganese from about .5 to 1 per cent is accompanied by an increase in tensile strength, a definite change in the shape of the dilation curve, and a marked variation in the microstructure." Published by the Michigan Engineering Experiment station, East Lansing, Mich.

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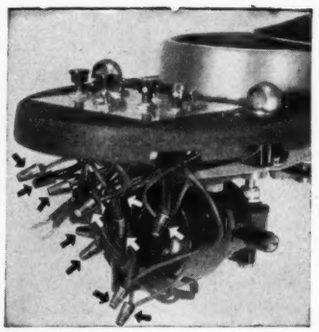

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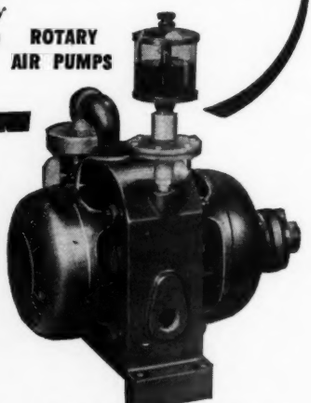

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GAST VACUUM PUMPS

Cycle Control Increases Production

(*Concluded from Page* 54)

to cut close enough to keep the screen clean. In the machine under discussion, therefore, a slotted screen is preformed in cylindrical shape. This slides easily into the basket when a lip ring *Fig.* 2 is removed, and is held firmly in place when the lip ring is re-installed.

To provide an opening for the chute it is necessary that the basket overhang the bearings. Two bearings are used, widely spaced, the one nearer the basket being a double row spherical, and the one at the far end a double row radial. A housing encloses both these bearings, and a constant oil level is maintained in the well of the housing. Attached to the shaft is a flinger dipping into the oil to raise it to channels that direct it to the bearings from which it flows back to the well once more. Although the same specification of oil is used for this purpose as for the operation of the hydraulic mechanism, the supplies in the casing are kept separate to avoid contamination.

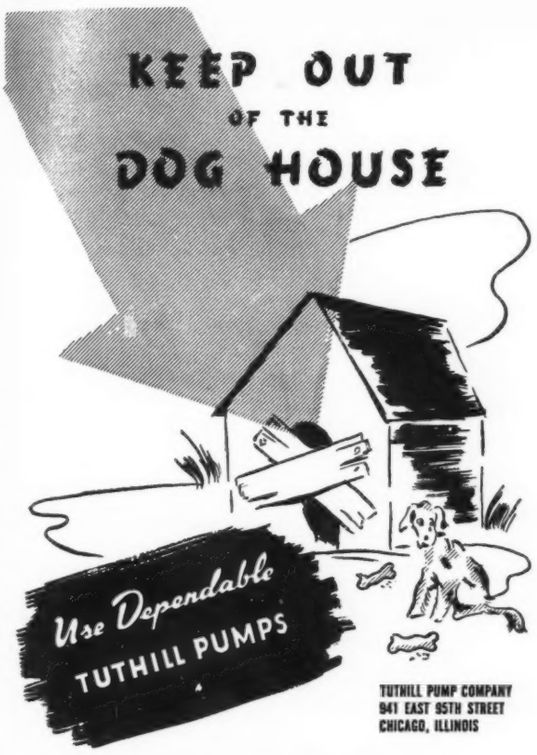
Use of an automatic timer system makes possible not only the adjustment of each step of the cycle to the minimum usable length of time, but permits any desirable extension of the cycle such as the introduction of additional spinning times, the multiplication of washes, and the separate collecting of wash liquids independent of the mother liquor.

Nickel-Copper Alloys Reduce Corrosion

BENEFICIAL effects of nickel upon the weathering resistance of steel increase with increasing nickel content and are enhanced by the addition of optimum amounts of copper, according to N. B. Pilling and W. A. Wesley, director and assistant director, respectively, of the International Nickel Co. research laboratory in a recent A. S. T. M. paper. Superiority of nickel-copper steels over copper steels is particularly pronounced in marine atmospheres to which the latter do not respond well. Effects of manganese, silicon and carbon contents do not appear to be important but the presence of a moderate amount of phosphorus seems to be beneficial.

Attention given to the mechanical properties of some of the newer types of high tensile strength construction steels has somewhat overshadowed consideration of the adequacy of their corrosion resistance. This factor is important with respect to the economy of weight-saving sheet steel. Unfortunately efforts to simulate weathering under accelerating conditions are not dependable. It is still necessary to conduct field tests of long duration in evaluating durability.

Tests during the past fifteen years, however, have made possible drawing of conclusions with a fair degree of accuracy with respect to the usefulness of



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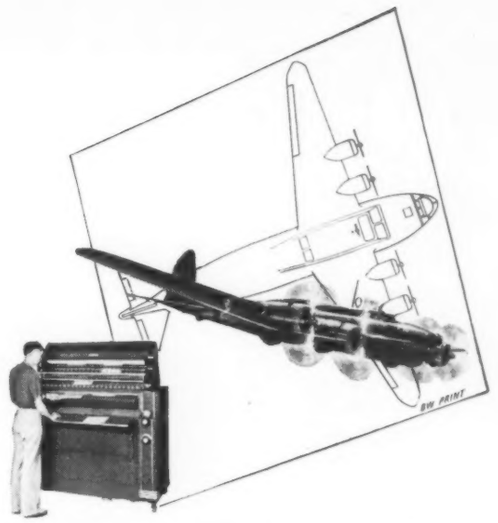

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And remember, this unit makes BLACK AND WHITE Prints—far easier to read and to check than blue prints!

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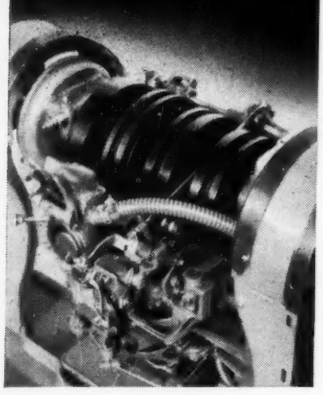
NEW TEXTOLITE LAMINATED USES



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nickel and copper additions. Four different locations were used; namely, a West Virginia farm miles from industrial activity, a beach in an isolated section of the New Jersey shore, a yard at Bayonne, N. J. near oil refining activity, and adjacent a railroad yard in Pittsburgh, Pa. The accompanying table shows the results of the tests for various steels.

Several nickel-copper steels were produced in a small high-frequency furnace from ingot iron and monel plus minor finishing elements. Ingots were forged to slabs and cold rolled to .02-inch strips which were finally annealed and ground bright. In the test, perforation of a sheet by corrosion at a distance ¼-inch or more from the edges was considered the criterion of failure.

Corrosion Resistance in Typical Atphospheres

Steel	Alloying Elements per cent					Life to First Perforation years			
	Nickel	Copper	Manganese	Silicon	Carbon	Rural	Marine	Moderate Industrial	Heavy Industrial
Ingot iron	....	....	.21	.03	.04	11	1.5	1.5	1.5
Copper steel	....	0.17	...	...	.07	14.5	1.5	3.0	2.1
Nickel-Copper									
2 per cent	1.39	0.61	.36	.14	.07	14.5	5+	4	3.2
4 per cent	2.76	1.18	.22	.08	.11	14.5+	5+	6	10
4 per cent	2.8	1.2	...	...	.1	14.5+	5+	10	14.5
6 per cent	4.2	1.8	.38	.13	.08	14.5+	5	8	14.5+
8 per cent	5.42	2.36	.40	.14	.08	14.5+	5+	14+	14.5+
10 per cent	6.95	3.03	.36	.14	.18	14.5+	5+	8*	14.5+
10 per cent	3.0	6.71	.40	.18	.05	14.5+	3.5	5.5	12

*Failed by cracking.

The nickel-copper steels consistently demonstrated superiority over the copper steel in the sulphurous atmosphere and showed a high degree of resistance in the marine atmosphere under conditions to which the copper steel did not respond well.

A group of eleven alloy structural steels was exposed to the Bayonne atmosphere in 1934. The specimens were 2.5 by 5 inches in size, cut from 22 gage, clean, pickled sheet. They were exposed in two ways: One set was mounted on a boldly exposed rack, the second set was exposed outdoors in a vertical position and half-immersed in water in an open unsheltered trough. The trough was kept full of water by rain and by use of an inverted bottle of distilled water as a constant level device.

Each steel was exposed in triplicate and it was planned to remove one piece of each trio from test at the end of 1, 3 and 8 years, respectively. The semi-immersion test was terminated at the end of twenty months. Although the corrosion losses of the partially immersed specimens were about double those in the atmospheric tests the damage done to the former was much greater because there was localization of attack near the water level or at the edges of the specimens. The more highly alloyed steels were definitely superior to the others in the partial immersion test.

In the atmospheric tests the more highly alloyed steels were again superior to the others in resistance to corrosion. The marked drop in corrosion rate with time in the first three years indicates that tests of this sort should be continued for many years if the true relative longevity is to be established.

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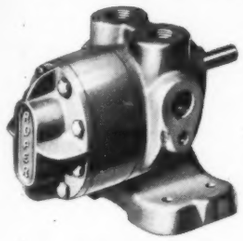

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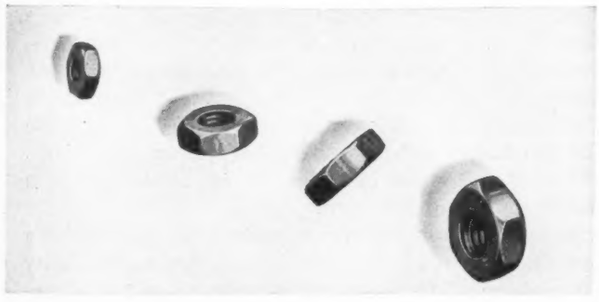

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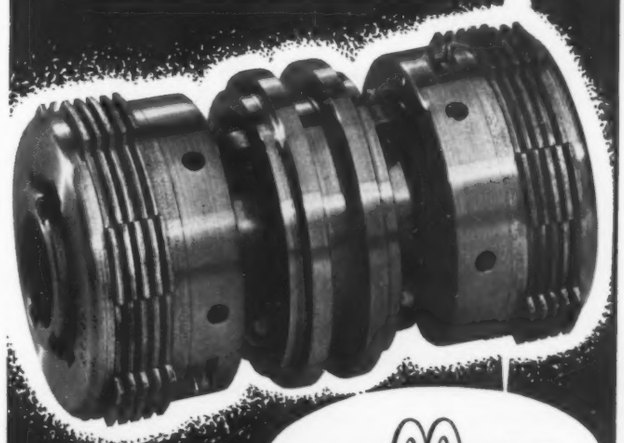

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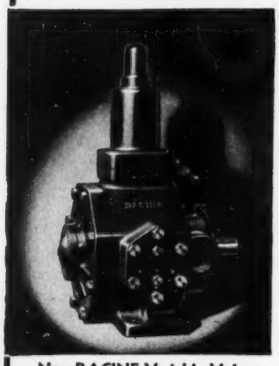

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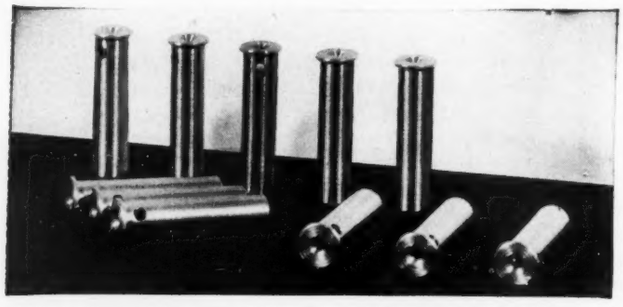

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Nation Needs Designers—Here's Training Course

(Concluded from Page 67)

which is usually a developmental laboratory. In each place an outstanding designer or developmental engineer supervises his work and takes special care to develop his abilities through discussions and personal example as a master mechanic would guide his apprentice. So far as possible the young engineer is given responsibility for design of an entire device.

Four or five times a year the designers in charge of the assignments gather at a conference to discuss the progress of the men in the course, new candidates and various aspects of the educational work. Through discussion, the strong and weak points of each student engineer are brought out so that those having contact with him may more effectively utilize the strong qualities and strengthen undeveloped ones.

Classroom and factory instruction is given to the mechanical design course group four hours each week. Subjects covered include materials, manufacturing processes, technical subjects like elasticity, dynamics and elementary differential equations, and graphics.

Design Projects Worked On

During the last third of the course each man works on one or more inventive design projects of his own selection as part of the homework and those who wish to construct working samples of their designs in their spare time have a well-equipped machine shop in the local technical high school for use.

About 25 young men have gone through this course since its inception and are now actively engaged in design and related activities. Some others who began the course were shifted to other kinds of work when they appeared to lack the necessary originality. While the percentage of such men has never been large, it shows that there is still room for improvement in the technique of selection.

Because it is almost impossible when appraising a new design to separate the results of innate ability from those of training, the suitability and effectiveness of a study course such as outlined above is largely a matter of conjecture. It is certain, however, that the rotating assignment part of the program is most beneficial because it both stimulates the young engineer through contacts with outstanding men and enables him to find a more satisfying position at the end of the course because of his better perspective.

MORE effective service to industry as well as to the engineering and architectural professions is effected by the recent merger of Armour Institute of Technology and Lewis Institute. Combined resources of the two colleges to form the Illinois Institute of Technology make it one of the largest organizations of its kind. Component colleges will retain their former identity and will be known as Armour College of Engineering and Lewis Institute of Arts and Sciences.

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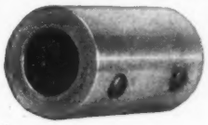

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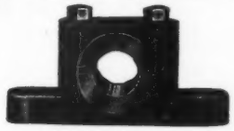

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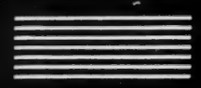

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Business and Sales Briefs

CARBOLOY CO. INC. is opening a branch office at 5905 Pacific boulevard, Huntington Park, Los Angeles in charge of J. W. Doody and Ray D. Mack. Mr. Doody has represented Carboloy on the coast for the past ten years, while Mr. Mack has served as field engineer in Wisconsin. Frank Staroba, formerly representative for Carboloy in Missouri, succeeds Mr. Mack in the Wisconsin territory, while E. Monacelli, recently in the Chicago area, is now in charge of the Missouri and southern district.

♦

The Manhattan Rubber Mfg. division, Passaic, N. J., announces that Condor whipcord endless belts are now available from stock for prompt shipment in a number of sizes and in two styles. The two styles carried in stock are capable of handling drives from ¼ to 25-horsepower and are applicable to more than 1500 different drives.

♦

To provide space for steadily expanding manufacturing facilities, Raybestos-Manhattan Inc. has purchased the Brighton Mills plant adjacent to the main plant of the Manhattan Rubber Mfg. division at Passaic, N. J. The property includes approximately 5½ acres on which are buildings with 240,000 square feet of floor space.

♦

Exclusive rights for the manufacture and distribution of Oman self-lubricating metal have been acquired by the Kitson Co., Philadelphia. Oman metal is not an alloy but is defined as a solidified emulsion of lead in copper produced by a secret process. The Kitson company has specialized since its inception in the manufacture of brass goods.

♦

Manufacturing facilities of the Seamless Flexible Metal Hose department of Eclipse Aviation, division of Bendix Aviation Corp., have been transferred to 545 North Arlington avenue, East Orange, N. J. Necessity for plant expansion prompted the move.

♦

Appointment of Lloyd B. Edwards and associates as district representatives for the Minneapolis territory is announced by the Universal Gear Corp., Indianapolis. Offices are at 851 Lumber Exchange building, Minneapolis.

♦

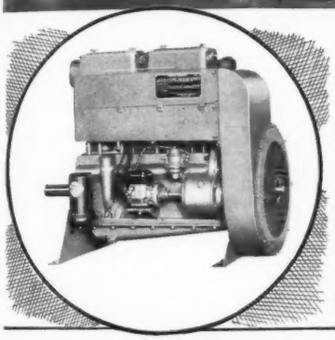
Addition of over 4000 square feet to the plant of the Kropp Forge Co., 5301 West Roosevelt road, Chicago, will house a new 14,000-pound steam hammer, two double-door billet heating furnaces and a 400-horsepower boiler unit supplying steam for the hammer. The new hammer went into service September 15 and enables the company to make hammer forgings several tons larger. This is the fourth major plant addition to the company since 1937.

♦

John L. Schmeller, long a member of the sales department, has been made vice president in charge of sales of the National Bronze & Aluminum Foundry Co., East Eighty-eighth street and Laisy avenue, Cleveland.

♦

S. C. DuTot has been appointed division sales manager, Electro Metallurgical Sales Corp., unit of Union Carbide & Carbon Corp., New York, in charge of sales activities in the Birmingham, Pittsburgh, Cleveland and Detroit areas. His headquarters will be in Pittsburgh. A district office will be maintained at Cleveland, with



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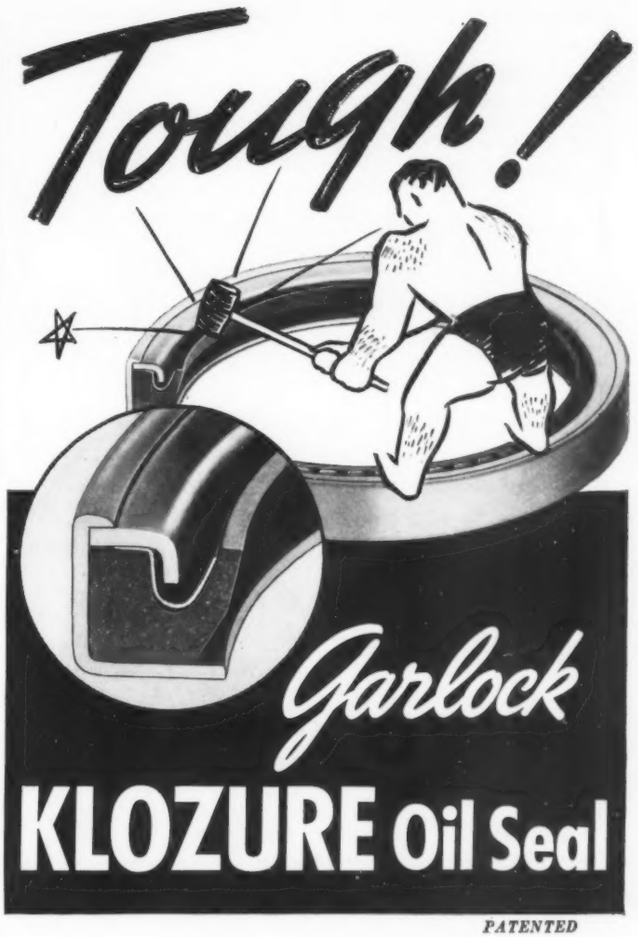

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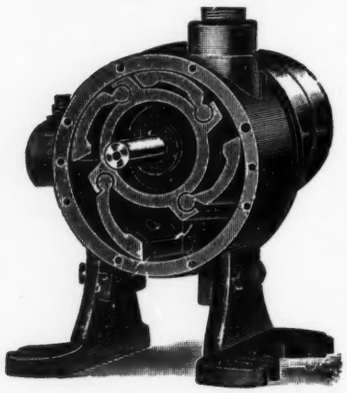

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E. E. Wright as manager, and at Birmingham, with F. H. Hanson handling sales and service in the southeastern states. W. E. Remmers has been named division manager in the Chicago area and R. E. Brown will be division manager of the West coast, with headquarters at San Francisco.

♦

Gilbert L. Wolfe has been appointed representative of the American Nickeloid Co., Peru, Ill., in charge of the Schenectady, N. Y., office. He will cover central New York state. Mr. Wolfe was formerly with Revere Copper & Brass Co. at Rome, N. Y., and New Bedford, Mass.

♦

Ralph W. Atkinson, 215 West Seventh street, Los Angeles, has been appointed West coast representative for the Tomkins-Johnson Co., Jackson, Mich. Weldon Engineering Co., 1791 Howard street, Chicago, has been appointed representative in the Chicago territory.

♦

Romec Pump Co., Elyria, O., has leased additional space adjoining its plant and will increase manufacturing facilities about 150 per cent. The company manufactures vacuum pumps, air compressors, liquid and high pressure hydraulic pumps.

♦

Production of special alloy steels for the aircraft industry has been extended by the Jessop Steel Co., 604 Green street, Washington, Pa., to include heat-treated and cold-drawn annealed bar products. All such steels are melted in electric furnaces, rolled to close tolerances, and magnaflux-tested to meet requirements of government specifications.

♦

Oliver Iron & Steel Corp., Pittsburgh, has appointed L. S. Cope as development engineer. His duties will include the technical improvement of the present line of Oliver products, development of new products, and co-operative service with Oliver customers.

♦

Ozalid Corp., Johnson City, N. Y., has become the Ozalid Products division, General Aniline & Film Corp.

♦

Link-Belt Co., Indianapolis, is humanizing the presentation of its five types of antifriction bearing units by comparing them with prize fighters and reclassifying the group according to various weights of fighters. Henceforth, series 100 will be called flyweight; series 400, welterweight; series 500, middleweight; series 600 heavyweight; and series 7200 alternate heavyweight. The whole line of these bearings will be known as Friction Fighter bearings.

♦

C. B. Ketcham has been appointed manager of the Cincinnati office and C. G. Jewett becomes manager of the Columbus, O., office of the Westinghouse Electric & Mfg. Co. Succeeding the late F. R. Colville in Cincinnati, Mr. Ketcham was Columbus manager for ten years, and has been with Westinghouse for nearly 30 years. Mr. Jewett was with the Cincinnati office for 15 years.

♦

Herbert J. Baer, 430 West Franklin street, Richmond, Va., has been appointed district sales agent for Virginia by Janette Mfg. Co., Chicago.

♦

David Fitzgerald, for the past six years auditor of the plastics department of the General Electric Co., Pittsfield, Mass., has been appointed assistant to G. H. Shill, manager of the department. A native of Hudson, N. Y., Mr. Fitzgerald started with General Electric in 1921.

♦

R. C. Garlick has been named general manager of sales, Sharon Steel Corp., Sharon, Pa. He was formerly manager of sales at Chicago. G. F. Griffiths succeeds Mr. Garlick as district sales manager at Chicago.

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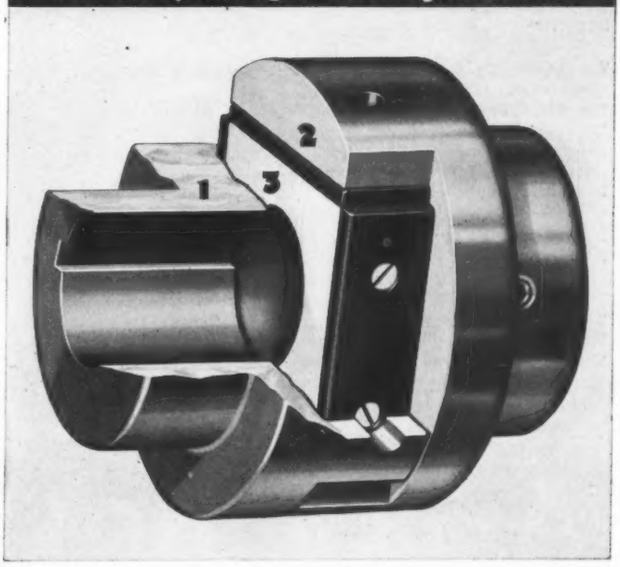
American Flexible Couplings

HAVE ONLY 3 SIMPLE–RUGGED PARTS

2 identical jaw flanges—1 floating center block



● One way to make sure your equipment will deliver full machine production with a minimum of "down time" for coupling care is to use a coupling that is simple and easy to adjust.

In American Flexible Couplings, the flexibility comes from advanced mechanical design—not from flexible materials. These couplings embody an improved application of the proven Oldham Principle of Power Transmission in an economical and rugged unit. The floating metallic center block (3) is free to float in any direction between identical jaw flanges (1) and (2) compensating for misalignment without sacrificing precision of movement between machines.

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AMERICAN FLEXIBLE COUPLING CO.
(Trade Name Reg. U. S. Pat. Off.)
Erie, Pennsylvania

AMERICAN FLEXIBLE COUPLINGS *provide complete flexibility without flexible materials*

NEW MACHINES—
And the Companies Behind Them

(For illustrations of other outstanding machinery see Pages 64-65)

Bakery
Baking and roasting ovens, G. S. Blodgett Co. Inc., Burlington, Vt.
Sixty-quart mixer, G. S. Blakeslee & Co., Cicero, Ill.

Diesel
Light-weight diesel engine, W. W. Gibson, Alameda, Calif.
Combination auxiliary unit, Lister-Blackstone Inc., Milwaukee.

Domestic
Winter air conditioner, Security Mfg. Co., Kansas City, Mo.
Room cooler, General Electric Co., Schenectady, N. Y.
Anthracite stoker, Iron Fireman Mfg. Co., Cleveland.

Finishing
Polishing lathe, Standard Electric Tool Co., Cincinnati.
Polishing and buffing lathe, Hammond Machinery Builders, Kalamazoo, Mich.
Superfinisher, Foster Machine Co., Elkhart, Ind.

Food
Vegetable and fruit filling machine, Chisholm-Ryder Co., Niagara Falls, N. Y.
Truck washer, Kelite Products Inc., Los Angeles.
Large capacity milk cooler, York Ice Machinery Corp., York, Pa.
All-electric space heaters for ice cream plants, Electric Air Heater Co., Mishawaka, Ind.
Pasteurizer tube cleaner, Mall Tool Co., Chicago.

Industrial
Hob-checking fixture, Michigan Tool Co., Detroit.
Aluminum super-speed scale, Detecto-Gram Scales Div., The Jacobs Bros. Co. Inc., Brooklyn, N. Y.

Materials Handling
5-ton elevating truck, Lyon Iron Works, Greene, N. Y.
Fast loader, Athey Truss Wheel Co., Chicago.
Trucks and tractors, Mack Trucks Inc., Long Island, N. Y.
Hydraulic lift truck, Lewis-Shepard Sales Corp., Watertown, Mass.

Metalworking
Pedestal-type grinder, The Hisey-Wolf Machine Co., Cincinnati.
Grinding machine, Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Hydraulic press, Colonial Broach Co., Detroit.
Tool room machine, Hack Machine Co., Chicago.
Intermittent type scrap cutter, F. J. Littell Machine Co., Chicago.
Electric aluminum rivet heater, American Car & Foundry Co., New York.
Chip-breaker grinder, Carboloy Co. Inc., Detroit.
Vertical milling machine, Midway Machine Co., St. Paul, Minn.
Precision gear and broach grinder, National Broach & Machine Co., Detroit.
Triple-action blankholder press, Hydraulic Press Mfg. Co., Columbus, O.

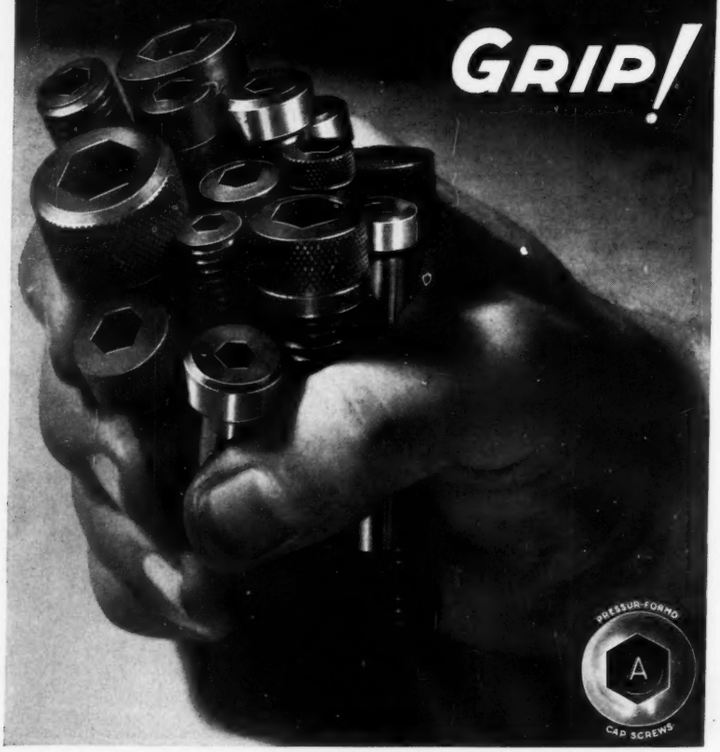
Restaurant
Automatic waffle baker, The Edison General Electric Appliance Co., Chicago.
Silver washer and drier, Foley-Irish Corp., New York.
Automatic toaster unit, National Stamping & Electric Co., Chicago.
Electric bulk ice makers, Carrier Corp., Newark, N. J.
Glass washing equipment, Olson Mfg. Co., Worcester, Mass.

Rubber
Sponge rubber vulcanizer, National Rubber Machinery Co., Akron, O.
Separation screens, J. H. Day Co., Cincinnati.
20-ton molding presses, F. J. Stokes Machine Co., Philadelphia.
Press for sponge or blown rubber goods, McNeil Machine & Engrg. Co., Akron, O.
Rubber specimen buffer, American Instrument Co., Silver Springs, Md.

Testing
Materials testing machine, Riehle Testing Machine Div., American Machine & Metals Inc., East Moline, Ill.

Textile
Dye beck, Rodney Hunt Machine Co., Orange, Mass.
Rotary fiber cutter, H. W. Butterworth & Sons, Philadelphia.

ALLEN HOLLOW SCREWS



The hand that grips these hollow screws holds the biggest handful of *gripping-power* so far available to engineers. This HOLD-ability of ALLEN screws *increases* with Allen advances in two directions:—

(1) Through improved methods of *cold-drawing* and *"pressur-forming"*, the screws are given more and more strength for tremendously tight set-ups.

(2) Through perfected threading, they have greater ability to resist loosening under vibration. The Set Screws are precision-threaded on lead screw threading machines. The Cap Screws are *"duo-process"* threaded, — which means (in addition to surface accuracy) that the axial fibres of the steel are made to conform to the contours of the thread profile.

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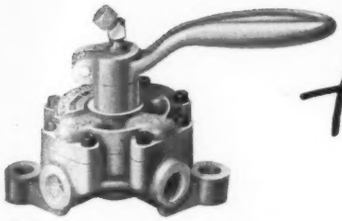
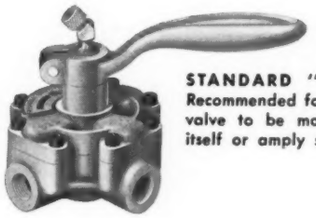


COLUMN MOUNT "UNITITE" VALVES: Recommended for remote control installations or where it is desirable to provide a support in addition to the piping.

for SIMPLE POSITIVE Control..

Hanna "Unitite" Valves



STANDARD "UNITITE" VALVES: Recommended for installations requiring valve to be mounted on the cylinder itself or amply supported by piping.

MANIFOLD "UNITITE" VALVES: Designed for installations where a number of valves must be located close together. All parts are in mounting face of valve.

IF your production requirements call for control valves to handle air, oil or water, look to Hanna "Unitite" Valves to do the job right. 5 sizes from ⅜" to 1¼" are available, for pressures up to 250 lbs. per sq. in. "Unitite" Valves are the packless type, with a simple but effective arrangement for lubrication of moving parts. All parts are precision-built to give years of trouble-free service under constant use. Write for complete details.

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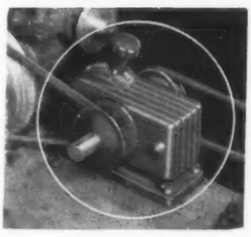

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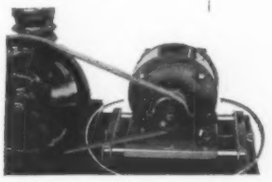

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